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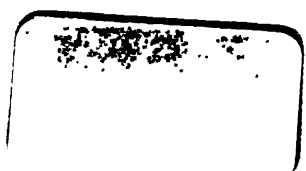
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Ind. y 8



REPORT

ON

SANITARY MEASURES IN INDIA IN 1881-2:

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1883

VOL. XV.

245.F

Presented to both Houses of Parliament by Command of Her Majesty.



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REPORT.

I.—EUROPEAN ARMY.

The health of the European Army in India during 1881 was more favourable than in either of the three preceding years. The average strength of the army during the year was 58,728; the admissions into hospital were in the ratio of 1,604 per 1,000, the daily sick 69 per 1,000, and the death-rate 16·86 per 1,000. The proportions in which the respective armies contributed to these results are shown in the following table:—

Sickness and mortality in 1881.

Presidency.	Average Strength.	Ratio per 1,000.		
		Admissions into Hospital.	Daily Sick.	Deaths.
Bengal* - - - -	35,901	1,729	72	17·05
Madras - - - -	10,391	1,160	60	10·97
Bombay* - - - -	9,895	1,784	72	13·44
South Afghanistan - -	2,541	968	72	51·55
Army of India - - -	58,728	1,604	69	16·86

* Excluding troops in Afghanistan.

Compared with the average of the 10 years 1870–79 the admissions and mean daily sick in 1881 were higher, but the deaths were $2\frac{1}{2}$ per 1,000 lower. Under all headings there was a decrease as compared with 1880, especially in the death-rate, which fell from 24·85 per 1,000 of average strength to 16·86.

Malarial fever as usual was the chief cause of sickness among the British troops, and enteric fever and cholera were the principal causes of mortality, the death-rates being 2·64 and 2·33 per 1,000 respectively.

Concerning the troops stationed in Bengal, which comprised nearly two-thirds of the entire army of India, the admission-rate, excluding troops serving in Afghanistan, fell from 1,813 per 1,000 in 1880 to 1,729, the daily sick from 75 to 72, and the mortality from 27·73 to 17·05. The death-rate also compares favourably with the two preceding decennial periods, for in the decennium 1860–69 the average death-rate was 29·98 per 1,000 or nearly 13 per 1,000 higher than in 1881, and in the decennium 1870–79 the death-rate was 21 or just 4 per 1,000 in excess of 1881. Dr. Cunningham remarks: “These data show that a very considerable reduction has been effected in the mortality of European soldiers in the Bengal Presidency during the last twenty-two years.” This decrease in mortality manifested itself throughout Bengal, and was most marked in the Gangetic Provinces and Oudh group of stations, where the mortality decreased from 29·32 per 1,000 in 1880 to 15·94. Of the six groups of stations into which Bengal is divided the Punjab group had the highest death-rate, namely, 23·44; this was also the case in the previous year when it stood as high as 36·41.

Out of the 50 stations included in the six groups of stations, Delhi and Amritsar furnished the highest rates of sickness, the admissions in each station being over 3,000 per 1,000, Peshawar following with 2,966: in each of these three stations over 2,000 of the admission-rate was due to fevers. As regards mortality, four stations, all of the Punjab, had death-rates of over 40 per 1,000—Jullundur 40·60, Amritsar and Govindgarh 46·61, Meean Meer 84·08, and the adjoining fortress of Lahore 137·93 per 1,000. This deplorable mortality was mainly due to cholera, as no less than 53·37 and 112·07 of the total death-rates of the two last stations were due to this disease. Of the total 80 deaths from cholera which occurred in the Punjab all but one were recorded in the above four stations. Among the stations with low death-rates were Saugor 2·69, Jhansi 2·80, Fort William 4·32, and Chakrata 4·74. Fort William continues among the healthiest stations of Bengal as is shown by the fact that its mortality for the year was less than one-half of what it was in 1878, viz. 9·36. The Army Sanitary Commission notice that in former times Fort William was the most unhealthy spot in India, or perhaps anywhere else, for European troops. Its death-rate for 10 years preceding 1866 was 102·35 per 1,000. Since then great improvements in

barracks, drainage, water-supply, &c., have been carried out, and in the decade 1860-69 the death-rate was 25·19 per 1,000, while in the ten years 1870-79 the mortality had fallen to 10·78 per 1,000.

In all respects the European army of Madras was healthier than either that of Bengal or Bombay, although there was a slight increase in mortality compared with the previous year. The admission-rate declined from 1,368 in 1880 to 1,160 per 1,000 of average strength, the daily sick from 64 to 60, while the death-rate rose from 10·18 to 10·97 per 1,000. In both years, however, the mortality was six per 1,000 less than the average of the preceding ten years. The most unhealthy station in the Madras command was Kamptee, which recorded a death-rate of 26·58 per 1,000, more than a half being due to cholera. In the previous year the mortality at this station equalled 20·73 per 1,000, but there were no cases of cholera. The stations of Cannanore and Bangalore and Tounghoo in British Burma furnished the most favourable mortality returns. At the two former stations the death-rate was a little over 5 per 1,000, and in the latter 4·44.

There was a great improvement in the health of the European troops in the cantonments of the Bombay Presidency, the admission-rate having decreased from 2,150 in 1880 to 1,784 per 1,000 in 1881, the daily sick from 78 to 72, and the mortality from 30·90 to 13·44. The average death-rate of the decennium 1870-79 was 15·27. The statistics of individual stations shows that Aden was the most healthy. There the admissions were 805, the daily sick 32, and the death rate only 3·96 per 1,000 against 20·35 in 1880. The stations which returned the highest death-rates were Nasirabad, Baroda, Ahmedabad, Karachi and Ghizree, and Ahmednagar, these ranging from 18·84 to 27·21 per 1,000.

The force on service in Afghanistan was composed of troops partly from Bengal and partly from Bombay, and, as shown in the statement at the beginning of this section, that portion of the European Army of India furnished the most unfavourable returns. The admission-rate (968 per 1,000) was low, but the daily sick-rate (72) was high, as was also the death-rate (51·55 per 1,000).

Cholera.

Cholera was the cause of 137 deaths, equal to 2·33 per 1,000 of strength against 2·81 in 1880. The disease was chiefly confined to the Bengal Army, and resulted in a mortality of 116 or 3·22 per 1,000. It prevailed as an epidemic at Meean Meer from June to August, during which time exactly one half of the 116 deaths which occurred in Bengal took place. About the same period there were 13 deaths at Fort Lahore; and later in the season there were 17 deaths at Lucknow. In the Madras Army there were 18 cholera deaths or 1·73 per 1,000 of strength, and in Bombay only three deaths. The troops in Afghanistan were entirely exempt from the disease. "The practical result of the history of cholera at stations of European troops is," the Army Sanitary Commission remark, "that in the course of improvements at these stations a great reduction in the death-rate from cholera has taken place, but that the disease shows a tendency to periodical outbreaks at certain well-known stations. It is at these that special sanitary precautions should be taken, and if there are no known means of reducing the recurring mortality, the probability will be that the causes are topographical, and that there are such causes is well known in the history of cholera. The remedy in such cases is also well known, and this is simply leaving the locality."

Fevers.

Fevers as usual caused the greatest amount of sickness in the three armies, the admissions per 1,000 of strength, excluding troops in Afghanistan, being 770 in Bengal, 280 in Madras, and 845 in Bombay. The most prevalent form was the intermittent, but enteric fever the most fatal. The admissions in the entire army on account of this fever numbered 328 against 470 in 1880, and the deaths 155 or 2·64 per 1,000 against 217 or 3·63. In Bengal the death-rate due to enteric fever was 2·62 against 3·69 in the previous year. Although the disease had been very widely distributed in Bengal, its prevalence was most marked at the stations of Lucknow, Rawalpindi, Bareilly, Meean Meer, Dum-Dum, and Ranikhet, among which there were 109 admissions and 33 deaths, being a little over one-third of the total (94) deaths. In Madras the enteric fever death-rate was 0·58 per 1,000 against 1·36 in 1880, and in Bombay the mortality was less by over one-half, the ratio having fallen from 5·76 in 1880 to 2·83. Among the troops employed in Southern Afghanistan, the death-rate on account of enteric fever was 10·62 per 1,000.

The influence of age on mortality by enteric fever is again shown by the fact that 108 of the 155 deaths occurred among men under 25 years of age, being in the proportion of 4·56 per 1,000 of the strength at that age, while 1·57 were from 25 to 29, and 0·79 from 30 to 34 years of age. According to length of residence in India the mortality from this fever was distributed as follows: 2 years and under, 4·55 per 1,000, 3 to 6 years 2·07, 7 to 10 years 0·56, 10 years and upwards 0·40.

"There can be no doubt," the Army Sanitary Commission state, "that, whatever may be the influence of local and climatic causes in predisposing to enteric fever, the subject; the young soldier, is the main death cause, and that to obtain the highest enteric fever death-rate, it is only necessary to send him to India and bring him back under the short-service system . . . The amount of fever and of fever liability will no doubt vary in some years, but with the present terms of army service this fatal fever will form an important item in the Indian Army death-rate. This is the result of long past as well as of present experience, and all that can be done of a practical character is to try to diminish liability in young soldiers first landing in India, by having drill completed before landing in India, by exercising great care over the habits of these young men until they are accustomed to the climate, by placing as many of them as possible at hill stations, and by rigid attention to every local sanitary precaution. The need for this last recommendation appears to be shown by the fact that there are stations scattered all over India in all varieties of Indian climates and temperatures at which the amount of enteric fever is much greater than at others."

Next to fevers, venereal diseases caused the greatest amount of sickness. The experience of the year respecting these complaints, Dr. Cunningham observes, again proves the failure of the lock hospital system: "Taking the statistics of the last 12 years, during which the returns of the army of the three Presidencies have been tabulated on the same plan, and during which period also the lock hospital system has been very generally adopted, it is found that the admissions into hospital from venereal diseases are as great as ever." For the entire army the admission-rate for 1881 was 260 per 1,000, just 10 per 1,000 higher than that of the previous year, and 57 per 1,000 in excess of the mean of the 10 years 1870-79. Excluding troops in Afghanistan, the admissions in Bengal were 276 per 1,000, the same as in 1880, and 67 per 1,000 higher than the average of the preceding decennium; in Madras the admissions declined from 275 per 1,000 in 1880 to 258; and in Bombay from 269 to 261. It will thus be seen that upwards of one-fourth of the army was infected with these diseases during the year. Venereal diseases.

There was a considerable increase of primary syphilis in Bengal, but a decrease in Madras and Bombay; and the fact that there has been no diminution in the proportion of secondary syphilis supports the opinion that lock hospitals have been of little help in rendering the type of the disease less virulent. These unfavourable results, Dr. Cunningham again points out, "may in some measure be accounted for by the increased youth of the army, and by the smaller proportion of married men; but making every allowance for these factors, the failure of the lock hospital system is still most decided."

The invaliding statistics show that 2,241 men, equal to 38·36 per 1,000 of strength, were invalided during the year, of whom 778 were recommended for discharge from the service, and 1,463 for change. No satisfactory comparison can be made with the results of 1880, owing to the non-receipt of the returns of several corps in that year. Compared, however, with the average of the 10 years 1870-79 (43·04), the ratio for 1881 stood about $4\frac{1}{2}$ per 1,000 lower. The invaliding rate was highest in Bombay, 53·35, Bengal following with 36·92, while Madras returned 27·91. The chief causes of invaliding were debility, hepatitis, dysentery, diarrhoea, and phthisis. According to age 33·74 per cent. of the total number invalided were under 25 years of age, and 34·58 per cent. from 25 to 29 years of age. As regards residence, 14 per cent. of the total invalided had been less than two years in India, and 30·20 per cent. had served there from two to five years. Invaliding.

Dr. Cunningham in his report gives a table showing the unfavourable influence of the climate of India on newly arrived regiments as compared with the health of the army generally, and from this it appears that the admission-rate of new regiments was over 200 per 1,000 higher than that of the army as a whole, the daily sick 5 per 1,000, and the death-rate over $6\frac{1}{2}$ per 1,000 higher. From enteric fever the death-rate was 8 per 1,000 higher.

Owing to the discrepancies in the figures as to the extent of intemperance in different regiments of the European army, the returns have been discontinued. Intemperance.

II.—NATIVE ARMY.

Sickness and mortality in 1881.

In the health of the Native troops there was a very material improvement in 1881, the mortality having been little more than one half of what it was in the previous year, and there having been also a marked diminution of sickness. Of an average present strength of 114,613, the admissions into hospital were 1,305 per 1,000, against 1,545 in 1880; the daily sick 46, or 10 per 1,000 less; and the death-rate 19·24 against 39·22; including men absent from their corps, the mortality equalled 22·62 against 41·12 per 1,000. The ratios for 1881 were considerably lower than the means of the quinquennium ending with that year. Of the chief causes of sickness and mortality, nearly one-half of the admissions was due to paroxysmal fevers, and one-third of the deaths was occasioned by respiratory diseases. Cholera deaths numbered 111, or 1·94 per 1,000, against 67, or 0·97 in 1880.

The sickness and mortality of the various portions of the Native army are shown in the following table :—

	Average Strength.	Ratio per 1,000.		
		Admissions.	Daily Sick.	Deaths.
Bengal Native Army - - -	38,721	1,494	52	23·84
Ditto ditto excluding Afghanistan - - -	36,896	1,495	51	19·76
Madras Native Army - - -	28,533	997	41	12·02
Bombay Native Army - - -	24,945	1,471	50	25·58
Ditto ditto excluding Afghanistan - - -	18,349	1,166	41	14·01
Central India Regiments - - -	5,039	815	26	12·11
Punjab Frontier Field Force - - -	10,307	1,718	55	17·95
Hyderabad Contingent - - -	7,068	673	24	7·78
Native Army of India - - -	114,613	1,305	46	19·24

Bengal Native Army.

It will be seen from the above that about one-third of the men composing the Native army of India belonged to the Bengal command, and that of these nearly 2,000 were on service in Southern Afghanistan. The statistics of the Bengal troops in cantonments for 1881 compare very favourably with those of 1880, the admissions per 1,000 of average strength having fallen from 1,609 to 1,495, the daily sick from 65 to 51, and the mortality from 33·85 to 19·76. Under nearly every heading of disease there was a diminution in mortality, the decrease being most marked under respiratory diseases, the death-rate having decreased from 7·21 in 1880 to 6·59 per 1,000 in 1881; fevers also declined from 9·19 to 3·12, bowel complaints from 6·13 to 2·74, and cholera from 1·52 per 1,000 to 0·92.

The following table shows the sickness and mortality of the five groups of cantonments in which the regular Native troops in Bengal were stationed in 1881 :—

	Ratio per 1,000.		
	Admissions.	Daily Sick.	Deaths.
Bengal Proper and Assam - - -	1,772	63	22·53
Gangetic Provinces - - -	1,260	46	15·78
Rohilkund and Meerut - - -	1,378	60	15·67
Agra and Central India - - -	1,380	41	9·35
Punjab - - -	1,521	48	22·86

In every group there was a great decrease in mortality, and was most marked in the Agra and Central India group, in which the death-rate fell from 28·52 per 1,000 in 1880 to 9·35. The Punjab group also shows a satisfactory improvement in this respect, the death-rate being 15·16 per 1,000 less than that of the previous year, and in the Bengal and Assam group the mortality although high was but little more than half the ratio of 1880. Fevers, as usual, were the chief causes of sickness in all the groups, and were more prevalent in Bengal and Assam than in any other group. In this group also the admissions from bowel complaints were more numerous than in any other, while respiratory diseases and all the other forms of sickness in which malaria plays a

prominent part were very prevalent. As a proof of the malarial character of the diseases in the Bengal and Assam group it may be stated that one-half of the total death-rate (22·53) was due to fevers, bowel complaints, and respiratory diseases. The same may be said of the Punjab group, where three-fourths of the total mortality (22·86) were recorded under these headings.

The statistics of individual stations show that sickness was most prevalent at Dharmasala, where the admission-rate reached 2,752, of which no less than 2,142 were ascribed to fevers. Delhi comes next with 2,732, over 2,000 of which were due to fevers. Four other stations, Meean Meer, Alipore, Barrackpore, and Dinapore, recorded admission rates of over 2,000. The greatest mortality was registered at the station of Nowshera, 53·18, Fyzabad following with 50·82. In the previous year the death-rate at the latter station was 96·67 or nearly twice as high. The greatest number of deaths occurred at Peshawar and its outposts, where out of a total of 90, as many as 55 were due to respiratory diseases.

Among the Bengal Native troops in Southern Afghanistan the admission-rate, 1,475 per 1,000 of average strength, was by no means great, but the death-rate, 106·30 per 1,000, was more than five times the average of the Bengal troops in cantonments. The total deaths numbered 194, of which 55 were due to respiratory diseases and 57 to bowel complaints, while paroxysmal fevers gave rise to 24 deaths and anemia and debility 11, so that under these four headings 147 of the total deaths were due, more or less directly, to malarious influences. Neither cholera nor enteric fever attacked this force.

In the Punjab Frontier Force there was a diminution of sickness and also of mortality. Excluding troops in Afghanistan the admissions decreased from 1,874 per 1,000 in 1880 to 1,718, and the mortality from 24·03 to 17·95. Out of 185 deaths 88, or nearly one-half, were attributed to respiratory diseases, and 24 to fevers, 5 of which were recorded as enteric. There was no case of cholera in this force.

The rates of sickness and mortality in the Central India Regiments and the Hyderabad Contingent also show a satisfactory decrease. The admission-rate of the former was 815 per 1,000 against 1,131 in 1880, and the death-rate 12·11, less than half what it was in the two previous years. Nearly one-half of the total 61 deaths in this force was due to respiratory diseases, and 12 to fevers, while cholera was absent. But of all Native corps the Hyderabad Contingent was the most healthy, the mortality being only 7·78 per 1,000, which is almost identical with the two previous years, and the admission-rate was as low as 673 per 1,000 against 1,030 in 1880. In this contingent there were 12 cases of cholera, four of which proved fatal.

In the health of the Native troops of Madras, there was a considerable improvement. The admission-rate (997) was 400 per 1,000 lower than in 1880; the daily sick (41) 13, while the death-rate decreased from 15·57 to 12·02 per 1,000, or, including absent deaths, from 19·54 to 16·75. From nearly every cause of disease there was a decrease in mortality excepting cholera, and from this disease the deaths rose from 3 in 1880 to 39. Of this number, 14 occurred at the station of Kamptee, and 18 at Trichinopoly. Of the total 343 deaths, 51 were attributed to fevers, 42 to bowel complaints, 33 to atrophy and anemia, and 45 to respiratory diseases. Dropsy was the cause of 29 deaths, but of these 20 were due to beri-beri, a disease which prevailed more or less generally throughout the year. Among the larger stations of the Madras Presidency, five returned death-rates exceeding 20 per 1,000, the highest, 32·66 per 1,000, having been recorded at Rangoon, Vizianagram coming next with 23·65, Kamptee with 21·82, Trichinopoly and Vizagapatam following with 21·65 and 20·93 respectively.

Madras
Native
Army.

Over one-fourth of the Bombay Native Army was on service in Southern Afghanistan during the year; but for the unhealthiness of this portion, the returns would have shown much more favourable results. As regards the troops serving in cantonments, the admissions fell from 1,283 per 1,000 in 1880 to 1,186 in 1881, the daily sick from 45 to 41, but the death-rate, that is, of men present with their regiments, rose from 10·44 to 14·01; including absent deaths, the mortality of 1881 stands at 25·93 per 1,000 of total strength, less than half what it was in 1880, namely 56·93. It must not be forgotten, however, that the mortality of 1880 includes the casualties which occurred at Maiwand and Deh Kohja in Afghanistan. The greatest sickness occurred among the troops stationed in the Persian Gulf, the admission-rate reaching 2,457 per 1,000 of an average strength of 153. Judged, however, according to mortality, the most unhealthy station was Surat, which recorded a death-rate of 40·76, nearly half of which was due to cholera. Only at two other stations did the mortality exceed 20 per 1,000, and these were Karachi with a death-rate of 24·56 and Ahmedabad with 20·54. The chief causes of mortality among the troops in cantonments were respiratory diseases, fevers,

Bombay
Native
Army.

and bowel complaints, and under these three headings more than half the total 257 deaths were returned. From cholera there were 34 deaths.

Out of an average strength of 6,596 men composing the Bombay Native troops on service in Afghanistan during 1881, the daily sick was 76 per 1,000, the admissions 2,317, and the mortality 57·76, all of which it will be seen were greatly in excess of the returns of troops in cantonments. Respiratory diseases were very fatal in this force causing no less than 218 of the total 381 deaths, and the ratio of admissions on account of these diseases was 301·2 per 1,000 as compared with 65·9 in cantonments. To dysentery and diarrhoea 49 deaths were attributed, and to fevers 34. Cholera was absent from this force.

III.—GENERAL POPULATION.

THE following statement shows the registered mortality in the different provinces of India from the four principal diseases and from all causes in 1881 :—

PROVINCES, &c.	CHOLERA.		SMALL-POX.		FEVERS.		BOWEL COMPLAINTS.		DEATHS FROM ALL CAUSES.		
	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000.	Total Deaths.	Ratio per 1,000 in 1881.	Ratio per 1,000 in 1880.
Bengal excluding Calcutta - - -	79,180	1·32	24,371	0·40	940,911	15·71	57,029	0·95	1,255,478	20·96	15·40
Calcutta - - - - -	1,603	3·90	133	0·03	3,765	8·69	1,461	3·44	13,030	30·00	27·19
Madras - - - - -	9,446	0·32	15,766	0·55	203,542	7·09	18,961	0·60	465,632	16·20	15·71
Bombay - - - - -	16,694	1·01	539	0·03	272,403	16·56	30,342	1·84	381,450	23·18	20·25
Punjab - - - - -	5,207	0·30	6,749	0·38	355,279	20·32	17,231	0·99	519,779	29·72	27·03
North-Western Provinces and Oudh -	25,865	0·58	17,153	0·39	1,100,599	24·95	82,314	1·88	1,402,473	31·79	29·99
Central Provinces - - - - -	9,140	1·23	1,516	0·24	143,933	19·42	22,133	2·98	241,467	32·59	29·10
Berar - - - - -	3,404	1·29	225	0·08	41,631	15·84	11,951	4·54	76,661	29·14	23·65
Assam - - - - -	5,010	1·12	3,129	0·69	42,553	9·49	9,865	2·20	71,941	16·04	13·61
British Burma - - - - -	5,239	1·42	1,766	0·48	27,743	7·51	3,808	1·03	58,136	15·75	17·72

For some years past the registration of births in Bengal has been confined to certain selected areas, but very little progress has been effected. Hopes, however, are entertained that better results will be secured when boards have been formed under the local self-government scheme. During 1881 births were registered in the same 46 towns as in the previous year, and the returns show a slight improvement, the number having increased from 35,779 or 23·44 per 1,000 of population to 38,856 or 25·51. In 20 towns the birth-rate was below the average, ranging from 5·92 to 24·68 per 1,000, and only in 16 towns were births recorded in excess of deaths.

A greater number of deaths were registered in 1881 than in any year since registration was inaugurated in 1870. This is attributed partly to an improvement in registration, more attention having been paid to the subject by district and local officers, but chiefly to the great unhealthiness of the year, both cholera and fever having prevailed to a most unusual extent. The number of deaths recorded was 1,255,478 or 20·96 per 1,000 against 922,633 or 15·40 in 1880. Little reliance can, however, be placed in the ratios as they have been calculated on the census population of 1871, which is about 10 per cent. below that of 1881.

Cholera deaths rose from 39,643 or 0·66 per 1,000 to 79,180 or 1·32. These were recorded in 594 registration circles out of 674, and in 8 per cent. of the villages. The disease was most severely felt in the Presidency and Orissa divisions, displaying its greatest severity in the districts of Balasore, Nuddea, and Cuttack, where the death-rates were respectively 4·93, 3·38, and 3·34 per 1,000. Among the towns Poori suffered most, yielding 370 deaths or 16·30 per 1,000 of a population of 22,695. All the large fairs were exempt from cholera outbreaks during the year, and with the exception of Bankoora the chief pilgrim routes escaped. The Army Sanitary Commission consider that of all diseases cholera affords the least reason for interference with pilgrimages: "The question," they state, "should be dealt with on much broader grounds, because by far the largest mortality from preventable epidemic diseases among pilgrims *en route*, and even at Poori, the great pilgrim centre, has been shown in the present Report not to be due to cholera." The year's experience as regards cholera in Bengal, "confirms," the Commission say, "but does not add to that of former years of cholera history. It shows the erratic nature of cholera distribution over a great region of India, and its presence in far greater intensity in some regions than in others, without any assignable cause. The intensity of the disease in localities was as usual influenced by local causes, certain of them connected with local topography, but, in the great majority of cases cholera being over the district, it swooped down wherever its presence was courted by insanitary local conditions; and experience of the results attending the removal of these conditions in well-defined instances is hopeful for future progress in improvements."

Small-pox deaths also rose from 22,953 or 0·38 per 1,000 in 1880 to 24,371 or 0·40 in 1881. Of these more than two-thirds occurred among children under 12 years of age. Deaths from this disease were recorded in 423 out of 674 registration circles, but only 8,759 villages out of a total of 200,321 were affected. Small-pox was most fatal in the five districts of Poori, Cuttack, Balasore, Noakhalli, and Chittagong, where the death-rate ranged from 6·09 to 0·92 per 1,000. The highest town death-rate was 17·53 per 1,000 in Poori, and in Balasore town the mortality reached 7·66. It is somewhat remarkable that in the Contai thana of Midnapore district, where inoculation is practised, not a single death from small-pox was reported, while the number registered in 1880 was 1,282. In Ranchi, where the disease had prevailed with some severity in former years, there was a great decrease in the number of deaths, only 12 being reported against 205 in 1880.

More fever deaths were registered in 1881 than in any previous year, the total being 940,941 or 15·71 per 1,000 against 689,605 or 11·51 in 1880. All the districts but two showed an increased mortality from this cause. In Nuddea the mortality attained most alarming proportions, and, notwithstanding that every effort was made to mitigate the sufferings of the people by the free distribution of medicines and other assistance, the fever death-rate rose from 29·53 per 1,000 in 1880 to 39·72. In consequence of this heavy mortality a Commission was appointed to visit the worst parts of the districts and to inquire into the conditions and causes of the outbreak. The Commission, it is reported, found no specific cause for the outbreak, and were satisfied that it was not due to artificial obstructions to natural drainage, as was popularly believed to be the case. They, however, drew attention to the insanitary condition of the villages, and pointed out a number of causes contributing to unhealthiness for most of which the villagers were themselves responsible. In their remarks on fevers in connexion with local and other influences the Army Sanitary Commission state: "Atmospheric causes may influence the number of fever attacks, but the extent to which these attacks may prove fatal is mainly dependent on purely terrestrial and local conditions over which we have control. We can cleanse and keep clean our dwellings and surroundings, we can protect water sources from impurity, we can keep the drainage of the country open, and we can relieve water-logged subsoils by drainage; we can so construct even the humblest dwelling as to avoid damp floors and damp walls without cost, and people who at present sleep on damp floors may be induced to raise their beds in some way above its level. If these things be done, and suitable provision for keeping cattle in their proper place be made, other things are sure to follow, such as better working power and better means for providing against atmospheric changes by food and clothing, and as a necessary result, there will be a great reduction of fever and general epidemic mortality."

From bowel complaints 57,029 deaths were recorded, equal to a ratio of 0·95 per 1,000 of population, against 44,969 or 0·75 in 1880. Deaths were registered in all the registration circles but 24, and in 12 per cent. of the total number of villages.

In Calcutta the year on the whole was an unfavourable one from a sanitary point of view. The registered deaths rose from 11,681 or 27·19 per 1,000 in 1880 to 13,030 or 30·0, calculated on the census population of 1881. The increase was chiefly due to cholera, the deaths from which were more than double the number of the previous year, namely, 1,693 against 805. From fevers there were 3,765 deaths, nearly the same number as in 1880, which is somewhat surprising, as in the adjoining districts of Nuddea and Moorshedabad fever mortality was exceptionally high. Small-pox also was slightly more fatal, the deaths having increased from 114 in 1880 to 133.

Madras.

There was a great scarcity of rainfall in all parts of the Madras Presidency during 1881, still food prices remained low; but the general health of the population was not so satisfactory as in the previous year. The total births registered was 731,866 or 25·5 per 1,000 against 659,991 or 22·9. This was a higher ratio than had been recorded in any of the preceding 12 years, and more than double the rate to which it was reduced in 1878, the year following the famine. It may be inferred therefore, that the registration, imperfect as it still is, was improving. The registered deaths numbered 465,682 or 16·2 per 1,000 against 454,101 or 15·7 in 1880, the increase being almost entirely due to cholera. The three highest district death-rates were 37·9 at Madras, 24·3 at Tanjore, and 21·7 at Chingleput. These three districts also recorded the highest birth-rates, and the satisfactory results obtained at the two latter is attributed to the special care and attention which the collectors had devoted to the subject.

The immunity from cholera, so characteristic of 1880, continued during the first nine months of 1881, when only 423 deaths were recorded, but during the last quarter of the year this pestilence made its appearance in the southern part of the Presidency, resulting in a total mortality of 9,446 against 613 in the previous year. Of these 2,220 were

registered as having died in the towns and 7,226 in the districts. The disease was principally felt in the Tanjore district, which recorded 2,801 fatal cases. Tinnevely came next with 2,206, and Trichinopoly followed with 1,804. It will thus be seen that these three districts contributed more than two-thirds of the total cholera deaths. In discussing the facts connected with the history of this disease the Army Sanitary Commission show that for the 16 years ending 1881 cholera had prevailed more or less epidemically in the Presidency at certain periods, followed in each case by two years of comparative quiescence, and they are of opinion that 1881 was the beginning of another epidemic period. They call attention to this the more especially as certain officers were disposed to attribute the epidemic of the year under review to returning pilgrims from the Tirupati festival. "There is no proof," they state, "that it had any influence on the course of a true cholera epidemic which covered Southern India."

Small-pox also was more prevalent than in the previous year, the deaths numbering 15,776 equal to 0.55 per 1,000, or 1,247 in excess of 1880. Ganjam, as usual, registered more deaths from this cause than any other district, viz., 3,038. Inoculation appears to be greatly practised in the more remote parts of this district, which, it is stated, no doubt accounts for its unenviable pre-eminence in regard to small-pox mortality. Young children were again the principal sufferers from this disease, for out of the total 15,776 deaths no less than 11,202, or considerably over two-thirds, occurred among children under 12 years of age.

Fever deaths were not quite so numerous as in 1880, the number having declined from 209,940 or 7.29 per 1,000 of population in that year, to 203,542 or 7.1 in 1881. In his report for 1881 the Sanitary Commissioner gives a table showing the number of fever deaths for each year since 1866, and from this it appears that during that period they have numbered 3,492,135. Dividing this period into two parts of eight years each, the deaths up to 1873 equalled 1,241,138, and for the subsequent eight years 2,250,997. Some allowance must be made for the heavy fever mortality of the famine years 1877 and 1878, but even omitting the deaths in these years, the number was considerably in excess of the octade ending 1873. The Sanitary Commissioner is unable to account for this augmentation in fever mortality, "unless it be the habit which obtains amongst the people all over the country of poisoning, by filthy practices, their water-supply, and their exposure by reason of their scanty clothing to vicissitudes of temperature." "No doubt," the Army Sanitary Commission observe, "there would be less fever if the whole Madras population was suitably lodged, clothed, and fed. But experience in other parts of India has shown that where malarial fever prevails with a certain degree of intensity, it spares neither rich nor poor. Improved social conditions can alone supply the want which Dr. Furnell (the Sanitary Commissioner) has dealt with, and climate cannot be altered."

Under bowel complaints 18,961 deaths were registered, equal to 0.6 per 1,000 of population, against 19,622 or 0.68 in 1880. These were returned from all the 227 registration circles except five.

Satisfactory improvement was made in the registration of vital statistics in the Bombay Presidency during 1881. The number of registered births rose from 370,873 or 22.85 in 1880 to 459,657 or 27.93 per 1,000 of population, calculated on the census of 1881. The increase was general throughout the Presidency, for only one district (Bombay city) out of 24 showed a decrease in number. The total registered deaths was 381,450 or 23.18 per 1,000 against 328,673 or 20.25 in 1880. It will thus be seen that the excess of births over deaths equalled 4.75 per 1,000 of population. In all the five divisions into which the Presidency is divided except the Konkan, the death-rate was higher than in the previous year. By districts the death-rates ranged from 37.91 in Broach to 6.56 in Sind. The latter ratio, the Army Sanitary Commission state, is apparently under the truth; but in the other districts there has been much good registration work done.

Of the chief diseases, cholera deaths showed a considerable increase, from 684 in 1880 to 16,694 or 1.01 per 1,000 in 1881. The disease, however, was not universally prevalent, for no deaths were recorded in the Sind division. Deaths were registered in 18 out of the 24 districts, and in 144 registration circles out of 285, but only six per cent. of the villages were affected. Of the districts, Khandesh contributed 3,176 deaths, Surat 2,751, and Ahmednagar 2,645. The circumstance of the year being one of heavy cholera mortality would seem to confirm the theory of the triennial choleraic wave. Statistics show, as the Sanitary Commissioner points out, that for 10 years, 1866 to 1875, the triennial occurrence was unbroken; in the eleventh and twelfth years the famine was a disturbing element, still the high number of deaths in the thirteenth year marked it as a recurrent year; the two next years showed a low mortality, and the sixteenth (1881) witnessed a renewal of the wave. In Bombay City there were 529 deaths against 30 in the previous year. The disease prevailed for 10 months out of the 12, and records show

that out of 408 months, making up the period from 1848 to 1881, it was present in this city in 389. With the view of showing the influence of improved sanitation on cholera visitations the Army Sanitary Commission divide this period of 34 years into two groups of 17 years each, as in the last period sanitary work in Bombay city has been more or less attended to. During the first 17 years, from 1848 to 1864, the cholera deaths numbered 37,454, and from 1864 to 1881 this number was reduced to less than one-third, namely, 11,026. "There is plenty of sanitary work," they say, "to be done in this great city of 773,196 inhabitants; but these facts, extending over a long series of years, appear to show that what has already been done has by no means been labour in vain."

The Presidency was remarkably free from small-pox during the year. Only 539 deaths were registered, being a smaller number than in any previous year since 1872, and less by 401 than that recorded in 1880. This mortality was confined almost entirely to the Konkan and Sind divisions, only 26 fatal cases of the disease having taken place in the three divisions of North and South Deccans and Gujarat. Seven districts out of the 24 were entirely exempt from small-pox, in nine the deaths were below 10, and in the remaining eight, Shikarpur as usual came first with a maximum of 202, Karachi following with 102.

Fever deaths rose from 246,779 or 15·21 per 1,000 in 1880 to 272,403 or 16·56 in 1881, a number which is also in excess of the average for the previous nine years. In the districts of Bombay City, Belgaum, Dharwar, Kaladgi, and Ratnagiri, there was less mortality than in the previous year, but in the remaining 19 there was an increase. The highest district fever death-rate was 33·14 per 1,000 in Broach, and the lowest, 5·37, in the Upper Sind frontier district. This general increase in fever mortality is attributed to an improvement in registration. The Deputy Sanitary Commissioner of the Northern Deccan Registration District is of opinion that not more than one-fifth of the deaths recorded as being due to malarious fevers belong properly to that malady, "the remainder being made up of simple continued fever, the result of climatic causes with its frequent resultant pleurisy and pneumonia in an underfed and ill-clothed population, and of typhoid fever. I consider," he says, "all these diseases, viz. cholera, fever, and bowel affections, are propagated by contaminated water; and if the death-rate is to be diminished, it can only be done by giving each village a good supply of clean water; and I hold that a public well under proper supervision in every village is a necessity more frequently calling for support, and is of more primary importance than education or hospitals, or any of the hundred and one demands made upon and granted out of village funds, whether local or municipal." But, while admitting the great danger to health of impure water, the Army Sanitary Commission point out that the purest water would afford no protection against either fever, cholera, or bowel complaints if other well-known causes of these diseases were left untouched. "Water unfit for human use," they state, "on account of animal impurities is something else besides a disease cause. It is a sign of filth and want of cleanliness about the water source or in the subsoil which supplies it, and no amount of well-digging will be a permanent advantage unless village cleansing and surface draining go along with it."

The deaths from bowel complaints were 30,342 or 1·84 per 1,000, being 5,890 in excess of 1880. In all the districts but five there was an increase, Khandesh recording the highest death-rate, namely, 3·68 per 1,000.

In the capital 21,856 deaths were registered during the year, exceeding the number of 1880 by 710. Calculated on the census population of 1881, the death-rate equalled 27·65 per 1,000. The increase in mortality was chiefly due to respiratory diseases and cholera, especially the former, the deaths from which rose from 1,973 in 1880 to 3,799. From cholera there were 546 deaths against 30 in 1880. On the other hand, fever deaths declined from 7,513 in 1880 to 6,437, and small-pox from 207 to 35.

Punjab.

Considerable improvement was effected in the registration of vital statistics in the Punjab in 1881. The year was the second of the registration of births for the whole province, and the returns give a total of 695,766 or 39·79 per 1,000 of population, against 544,659 or 31·15 in the previous year. The improvement was not confined to particular districts, but was almost general throughout the province, for only two out of 32 districts, viz., Ferozepore and Dera Ghazi Khan, showed a decrease. A further proof of the progress made in registration is the fact that the birth-rate exceeded the death-rate by nearly 10 per 1,000, and excepting in the four districts of Simla, Kangra, Amritsar, and Peshawar, births were everywhere more numerous than the deaths.

During the year 519,779 deaths were registered, equal to 29·72 per 1,000 against 472,731 or 27·03 in 1880, showing an increase of 47,048, which was due chiefly to a

considerable rise in mortality from cholera and fevers. The death-rate of the rural circles equalled 29 per 1,000 and that of the towns 48. By districts Amritsar recorded the highest mortality, namely, 50 per 1,000 against 29 in 1880, the excess being caused by a severe epidemic of fever in the town. Lahore came next with a death-rate of 41 per 1,000, being 10 per 1,000 in excess of the previous year, which was also due to fever. Ten other districts had death-rates ranging from 38 to 30, and 17 from 30 to 20 per 1,000. The highest town death-rate was 125 per 1,000 at Amritsar, Lahore following with 56. Of the total deaths 46 per cent. occurred among children under six years of age.

Of the chief diseases cholera showed a considerable increase, the deaths having risen from 274 in 1880 to 5,207 or 0·30 per 1,000 in 1881. Eight districts out of the 32 were entirely exempt from the disease, in eight others the deaths ranged from 1 to 6, in 13 the epidemic influence was mild, while in Lahore, Jullundur, and Amritsar it prevailed with great severity, especially in the former district, which recorded nearly a third of the total cholera mortality. Of the 5,207 deaths, 3,693 occurred in the municipal towns, the remainder in the rural circles. All the deaths were registered in 371 villages out of 34,973. A detailed account of the epidemic in its sanitary aspects is given in the Sanitary Commissioner's Report, and the facts adduced "clearly show," the Army Sanitary Commission observe, "that although much has been done of late years to improve the Punjab towns, as is evidenced by reduced liability to cholera, there is plenty of work to be done by the new municipalities of a thoroughly practical character. In the Punjab, as in other parts of India, the great predisposing disease-causes are to be found, not in public streets and places, but within the houses and compounds, and however cleaned and well drained and paved a public street may be, it by no means follows that public health in low, filthy, damp localities will be improved thereby."

Fewer deaths were registered from small-pox than in any previous year. They numbered 6,749 or 0·38 per 1,000 against 9,145 or 0·52 in 1880, and 49,489 or 2·83, in 1879. All the deaths but 445 occurred among children under 12 years of age. The disease was almost exclusively confined to the frontier districts, and was fatally prevalent in those of Peshawar and Dera Ismail Khan, which together yielded 2,875 deaths. "Although," the Sanitary Commissioner states, "there has been a most marked reduction in the small-pox death-rate in the last two years of 1880 and 1881, this diminution is by no means the result of the spread of vaccination. It must not for a moment be supposed that, because there have been only isolated cases in some districts, the disease was 'stamped out' in them. The painful memories of the havoc committed by this loathsome malady so lately as in 1878-79 are still fresh in the minds of the people. The enemy is surely not dead, but awaits for favourable circumstances—whatever they may be—to renew its work of destruction." It is satisfactory, however, to learn that since the amalgamation of the Vaccination with the Sanitary Department the Vaccination service has been reorganized and considerable additions made to the number of vaccinators, and it is hoped that under the new system district authorities will more earnestly co-operate in extending the benefits of vaccination among the people.

Under the head of fevers 355,279 deaths were registered, exceeding the number of the previous year by 27,552, the death-rate per 1,000 of population being 20·32 against 18·74 in 1880. The highest fever mortality was recorded in the district of Amritsar, namely, 35 per 1,000; Lahore also suffered very severely, the death-rate being 27 per 1,000; and in the districts of Delhi, Karnal, Umballa, Mooltan, and Muzaffargarh, the death-rates were very high. Out of the 28,962 fever deaths in Amritsar district, 11,724 occurred in the city alone, equal to a death-rate of 81 per 1,000. The outbreak was attributed to excessive and unusual rainfall, obstructed drainage, rise of the spring level, and consequent water-logging of the soil, combined with insanitary condition of crowded dwellings, imperfect conservancy, and contaminated water-supply. The Deputy Sanitary Commissioner (Dr. Bennett), who investigated the circumstances connected with this Amritsar outbreak, states in his interesting report that "at a comparatively early period of the outbreak the sickness was so universally prevalent, that not a single individual, Native or European, in the city and civil station appears to have escaped its attacks; nine-tenths of the shops are said to have been closed, and the work of the Government offices was carried on with the utmost difficulty owing to the general prostration and fever." The mortality was heaviest among the poorer classes, and cholera being prevalent added to the general distress. Children appear to have suffered to an appalling extent. "It would probably be no exaggeration to say," Dr. Bennett writes, "that two-thirds of the infantile population have died since the commencement of the outbreak, and that the health of the remaining third has been so shattered that

" comparatively few, among the poorer classes especially, are likely to survive beyond " their fifth year." In their remarks on this subject the Army Sanitary Commission state : " The history of this Amritsar fever is of great importance as showing the relation " of local and personal causes to abnormal rainfall in the chain of events, while it yields " an epitome of the action of fever-causes over most districts in India. But it does " more than this, for it shows in another form what relation to public health may at any " time exist between canal irrigation without drainage and abnormal rainfall." The investigation into the causes of this fever outbreak resulted in the issue of orders to remedy the defects of drainage and conservancy, and schemes for draining the whole locality with a view of obviating the swamping and water-logging of the soil and for improving the water-supply were under consideration.

Deaths ascribed to bowel complaints fell from 20,736 or 1·18 per 1,000 in 1880 to 17,281 or 0·99 in 1881, showing a decrease of 3,455. Out of 34,973 population groups, this mortality was confined to 6,099. Simla, as usual, recorded the highest district death-rate, namely, 2·83 per 1,000.

North-
Western
Provinces
and Oudh.

Satisfactory progress has been made in the registration of vital statistics in the North-Western Provinces and Oudh since its introduction in the combined provinces in 1879. During 1881 the registered births number 1,779,473 or 40·34 per 1,000, calculated on the recent census, which showed the population to be 44,107,869. In the previous year there were 1,390,870 births registered, equal to 32·55 per 1,000. In all districts excepting Kumaon, Terai, Dehra Dun, Fyzabad, and Ballia, the births exceeded the deaths, while in the previous year there was an excess of deaths over births in 25 districts. On the whole the birth-rate was higher than the mortality by 8·55 per 1,000. This general improvement was to a very great extent due to the new system of registration introduced during the year, under which every village watchman keeps a nominal register of births and deaths. A number of these registers was inspected by the Sanitary Commissioner, and he was satisfied as to their correctness.

The registered number of deaths was 1,402,473 or 31·79 per 1,000 against 1,281,155 or 29·99 in 1880. The district death-rates varied from 47·33 per 1,000 in Terai and 41·45 in Cawnpore to 20·76 in Dehra Dun, and the town death-rates ranged from 115·26 in Ajudhia to 16·31 in Muzaffarnagar. In many districts and municipalities the registered mortality was apparently below the truth, " but taken generally," the Army Sanitary Commission observe, " the recent improvements in registration methods have " led to more exact record of facts."

Cholera was considerably less prevalent than in 1880, the deaths having declined from 71,546 or 1·67 per 1,000 to 25,865 or 0·58 in 1881. These were registered in all the districts, but out of 117,630 centres of population only 4,573, being less than 4 per cent., furnished deaths. In his report for the year under notice the Sanitary Commissioner gives an account of the great fair (Magh-Mela), which was held at Allahabad in January 1882. The fair commenced on the 5th of that month, and lasted to the 3rd of February, and it is estimated that 3,000,000 of people attended it, the average attendance being about a million. Cholera broke out among the pilgrims on the 16th, and thenceforward continued with great severity. The outbreak would seem to have been greatly aggravated by overcrowding and the absence of sanitary precautions in the vicinity of the fair. The people becoming alarmed began to disperse, and by the 20th of the month the most severely affected areas were vacated. During the next three days the space between the station and the city was crowded with pilgrims trying to get away, and every day cholera cases were carried to the city hospital, a considerable number proving fatal. About 25,000 people left daily by the trains, among whom, as the Sanitary Commissioner remarks, were doubtless many affected with the disease. But no general outbreaks of cholera appear to have followed amongst the population through which the returning pilgrims passed or in the districts of their homes. With reference to the alleged spread of cholera from this fair, Dr. Cunningham states: " The experience of fairs and other " gatherings in India has again and again testified to the conclusion that cholera is not " carried by persons from one locality to another, so as to cause persons not themselves " exposed to the necessary local influences to become affected by the disease. Coinci- " dences certainly can be cited, in which the arrival of persons from a cholera-affected " district has been clearly followed by an outbreak of the disease; but even these " coincidences are far fewer than is generally supposed. An illustration of such a " coincidence is furnished by the history of the Magh mela."

Soon after the dispersion of the pilgrims from Allahabad, a fair was held at Hurdwar, about 450 miles north-west of Allahabad, but on a much smaller scale, the average daily attendance being 60,000. The fair commenced on the 6th of April and terminated on

the 16th. In contrast to Allahabad, the sanitary arrangements were highly satisfactory; only one cholera case occurred, which resulted in recovery. The Sanitary Commissioner states that he stayed at the fair until the assemblage had quite dispersed, and inquired carefully concerning the welfare of the retiring pilgrims, but neither saw nor heard any mention of disease among them.

Small-pox deaths rose from 8,240 or 0·19 per 1,000 in 1880 to 17,153 or 0·39. Of these, 15,401 were registered during the first six months of the year, chiefly in the months of the hot season, March, April, and May. Deaths were registered in all the districts, and in 673 registration circles out of 1,107. Although the epidemic covered a wide area, a very small number of population centres suffered—about one in fourteen—and in these, as noticed by the Army Sanitary Commission, the epidemic was of very low intensity, and showed little disposition to spread beyond the first cases attacked.

Fevers caused 1,100,599 deaths or 24·95 per 1,000 against 987,220 or 23·11 in 1880. But under this head a variety of diseases are supposed to have been registered; therefore, as the Sanitary Commission observes, “any small increase or decrease must not be taken to indicate with certainty any increase or decrease of fever prevalence.” All the districts returned fever deaths, and all the 1,107 registration circles with the exception of 16. In 18 districts the mortality was very high, Terai, as usual, coming first with a rate of 41·41, and Meerut, Bareilly, Ghazipur, and Ballia following with death-rates of over 30 per 1,000, while in 13 others the ratios ranged from 29·50 to 26·29. Of these 18 districts, eight are canal irrigated, and have always recorded high fever mortality, which the Sanitary Commissioner attributes to excessive moisture arising out of canal irrigation. In four other irrigated districts, with ratios ranging from 25·46 to 22·24, there was a decided falling off in fever mortality, which the Sanitary Commissioner says is satisfactory, and may result from the action of drainage works and a more careful distribution of water. “If this view be accepted,” the Army Sanitary Commission state, “it would follow that these drainage works had not only greatly reduced the liability to fever in the districts, but had removed the excess of rain, and consequently the additional mortality which otherwise might have been due to it.”

Under bowel complaints 82,184 deaths were registered against 80,312 in 1880, the ratio being 1·88 per 1,000 in both years. All the districts contributed deaths, and 1,029 out of the 1,107 registration circles. In eight districts the mortality was unusually high, averaging 6·7 per 1,000. Of these, Cawnpore showed the greatest increase, the death-rate having risen from 1·4 per 1,000 in 1878 to 6·3 in 1881.

The number of births registered in the Central Provinces during 1881 was 362,744 or 48·94 per 1,000 of population against 332,438 or 44·87 in 1880. The increase was pretty general, for only in four districts out of 20 was there a decrease, and in every district but one the birth-rate was over 40 per 1,000, whereas in 1880 six districts were below that ratio. In all districts the births exceeded the deaths, and, with few exceptions, in the towns also. Except for the sake of comparison, however, the ratios are of little value, as they have been calculated on the population of 1872, which the census of 1881 shows to have increased to the extent of about 25 per cent. A striking proof of the need for correction is given by the Sanitary Commissioner in the case of Murwara town, which recorded a birth-rate of 83·54 per 1,000 and a death-rate of 112·30, but which, calculated on the population of 1881 are reduced to 27·98 and 37·62 respectively, the population having increased from 2,885 in 1872 to 8,612 in 1881.

Of registered deaths there were 241,467 or 32·59 per 1,000 against 215,647 or 29·10 in 1880. Although showing an increase of 25,820, the year was not on the whole an unhealthy one; food grains were abundant and cheap, and in most districts the condition of the people was reported to have been more satisfactory; the increase in mortality would therefore seem to point to an improvement in registration. By districts the death-rate varied from 43·93 per 1,000 in Narsinghpur to 26·58 in Burhanpur. The average town death-rate was 40·65 per 1,000 against 32·59.

In the previous year there were only 350 cholera deaths; but in 1881 this number had increased to 9,149; though considerable, this number was small compared with 40,985 in 1878 and 27,575 in 1879. The disease was present in every district; the mortality, however, was strictly local, for only in 1,132 population groups out of a total of 27,247, including 72 towns, were deaths registered. One half of the towns were exempt from the disease, and with the exception of Kamptee, all the most populous towns were comparatively free. As pointed out by the Army Sanitary Commission, Nagpur yielded only 60 cholera deaths out of a population of 84,441, and Jubbulpore, although connected by roads and railroads with cholera-infected regions, had only 47 deaths out of a population of 43,223, while Saugor town, with 31,119 inhabitants,

escaped the disease. "These statistical facts," the Commission observe, "appear to justify an opinion that sanitary work, such as it was, in the towns and under the prevailing epidemic conditions, had been effective in saving life."

Small-pox was less prevalent than in any year since 1869, there being only 1,816 deaths against 5,184 in 1880. Every district was affected, but the outbreaks were local, as is shown by the fact that only 879 villages out of 27,247 returned deaths. Of the total mortality 35·4 per cent. occurred among children under one year of age, and 44·5 per cent. among children between one and twelve years. During the five years ending 1881 there had been 51,411 fatal cases of small-pox in these provinces and 1,507,288 vaccinations, equal to about one death for every 30 operations.

Deaths from fevers rose from 136,840 or 18·46 per 1,000 in 1880 to 143·933 or 19·42 in 1881. There was a general prevalence of fevers, no less than 21,497 villages having returned deaths. The district death-rates ranged from 5·89 at Nagpur to 32·24 at Narsinghpur. There is apparently, the Sanitary Commissioner states, too small a proportion of deaths returned from fever in some districts, while in others they are reported in undue numbers, and this he attributes to the too common practice of including almost every death under fevers.

From bowel complaints 22,133 deaths were registered against 19,205 in 1880, all being returned from 7,535 population groups, which the Army Sanitary Commission remarks throws doubts on the records or on the diagnosis.

Berar.

A considerable advance was made in the registration of vital statistics in Berar in 1881, and now that the revised rules for simplifying and improving the system referred to in Vol. XIV., p. 13, have received the sanction of Government, still further progress is expected in the future. The registered births for the year numbered 104,921 or 39·9 per 1,000 of population, according to the census of 1881, against 91,105 or 41·7 in 1880. The nominal decrease in the birth-rate is explained by the fact that the population had increased to the extent of 20·3 per cent. since the census of 1867. Had the birth-rate been calculated on the census of that year it would have equalled 48 per 1,000. In all districts births were in excess of the previous year, and in all cases they were more numerous than the deaths, the average excess for the entire province being 10·8 per 1,000.

The total number of deaths registered was 76,661 or 29·1 per 1,000 against 51,725 or 23·6 in the previous year. The increase of 24,936 deaths was due mainly to the prevalence of cholera, fevers, and bowel complaints, and to improvement in registration. The district death-rates ranged from 33·1 per 1,000 in Akola to 25·0 in Wun and 25·6 in Amraoti.

In 1880 cholera was entirely absent from the province, but in 1881 there were 3,404 deaths from this disease, showing a death-rate of 1·3 per 1,000. During the last 14 years, that is from 1868 to 1881, there has been a very great variation in the cholera death-rates. "No deficiencies," the Army Sanitary Commission state, "would account for them. They show a tendency to triennial periods subject to sudden augmentations in intensity, for which at present no reason can be assigned unless the facts be taken to show that the most predisposed part of the population are suddenly cut off, and then the disease subsides for a time." All the districts were visited by cholera, the greatest number of deaths having taken place in Buldana, Basim, and Akola, which together yielded 2,615 fatal cases. Several towns were entirely free from the disease, but in Malkapur and Akola towns the ratios were very high, viz. 8·1 and 9·8 per 1,000 respectively.

From small-pox the deaths rose from 39 in 1880 to 225. The only district in which the disease prevailed in an epidemic form was Akola, which contributed 196 of the total deaths; while Basim remained entirely exempt from the disease. Children were the principal sufferers, 104 of the deaths having occurred among those under one year of age, and between one and six years there were 106 deaths. "During the last three years," the Sanitary Commissioner remarks, "the recorded mortality from small-pox has been very much less than for any of the preceding ten years, and though this may be due in some measure to less severe visitations of the epidemic, still it does not seem unreasonable to suppose that this comparative freedom from disease may also in a great measure be due to the vigorous and earnest manner in which vaccination was carried on in this province."

The mortality under fevers was very great, the deaths numbering 41,681 or 15·84 per 1,000 against 31,027 or 14·18 in 1880. In each district there was a considerable increase. The maximum mortality to population was in the Wun District, namely 21·1 per 1,000, with an average rainfall of 44·11 inches; and the lowest mortality was 13·7 in

Buldana, where also the rainfall (26·20 inches) was less than in any other district. "In Wun District," the Sanitary Commissioner states, "the villagers use charpoys for sleeping on to a very much greater extent than in any other district of Berar, yet the fatality from fevers is always highest in this district." "This apparently exceptional result," the Army Sanitary Commission remark, "may possibly be due to local conditions of surfaces and subsoils, but it may also depend in part on the law of rain distribution, for, if the mass of the year's rain in Wun falls just before the time of increase of fever in other districts, Wun may suffer to a greater extent from this cause. All such exceptional cases merit investigation, because they throw important light on sanitary work. But it must also be borne in mind that a great part of fever mortality everywhere, and especially in Indian towns and villages, is due to aggravation of fever cases by purely local causes in and around dwellings."

The number of deaths ascribed to bowel complaints was 11,951 or 4·5 per 1,000 against 7,997 or 3·6 in 1880. The classification of bowel complaints is stated to be still very imperfect, deaths due to many other causes being classed under this head by the village registering agency.

The sanitary history of Assam in 1881 shows a remarkable improvement in the registration of vital statistics. In former years births were registered only in eight towns, but during the year under review the system was extended to six districts of the province. In the other two districts under registration, namely, Sylhet and Cachar, birth registration was to take effect in the former from 1st July 1882, while in the latter it appears that births have been recorded for many years, but by an oversight the statistics had never been returned, nor included in the provincial reports. In the six districts above alluded to, namely, Goalpara, Kamrup, Nowgong, Darrang, Sibsagar, and Lakhimpur, the number of births registered was 42,733 or 19·20 per 1,000, exceeding the death-rate by 2·27 per 1,000. Assam.

Deaths were registered to the number of 71,941 or 16·04 per 1,000 against 51,666 or 13·61 in 1880. The improvement which has taken place in the registration of deaths is somewhat obscured by the fact that the death-rate of 1881 was based on the census population of that year, which was found to have increased to the rate of 18½ per cent. since the taking of the previous census in 1871-72. All districts showed an increased mortality compared with the previous year, especially Kamrup, Nowgong, and Sylhet.

With regard to the causes of mortality, cholera was much more prevalent than in 1880, the deaths having risen from 2,803 or 0·74 per 1,000 to 5,010 or 1·12 in 1881. Although the disease was present as usual in each month of the year and in each district of the province, there does not appear to have been any great epidemic outbreak. Kamrup suffered more than any other district, recording 1,719 deaths or 2·66 per 1,000; Nowgong and Sibsagar followed with death-rates of 2·35 and 2·05 respectively. In the other five districts the mortality ranged from 0·84 to 0·02 per 1,000. Silchar was the only town that escaped the disease. Of the other seven, Gaubati recorded 216 deaths or 18·47 per 1,000, which was the highest local rate of the year. Cholera deaths were reported from 201 out of 389 registration circles, and from 620 villages out of 17,355. "Local damp or wet ground," the Army Sanitary Commission observe, "local filth and its consequences, foul well and tank water, appear to be the principal determining causes of cholera in Assam," and the protection of water sources from surface and subsoil filth must form an essential element in the sanitary improvement of every town and village in the province.

From small-pox there were 3,129 fatal cases or 0·69 per 1,000 against 2,239 or 0·59 in 1880. The disease prevailed throughout the province, no district or town escaping the scourge. According to ages 639 deaths were registered among children under one year of age, and 1,562 under 12 years. Small-pox was most markedly severe in Nowgong, where 197 villages registered 549 deaths, equal to 1·77 of population, and in Sibsagar 493 deaths were recorded in 194 villages, showing a death-rate of 1·33 per 1,000. In the districts of Goalpara and Cachar the death-rate was at a minimum, but in each of the other three districts the death-rates ranged from 0·60 to 0·67.

Of fever deaths there were 42,553 or 9·49 per 1,000 against 31,272 or 8·24 in 1880. The highest district fever death was 14·39 at Darrang, Nowgong coming next with 12·66; in four other districts the mortality ranged from 8·99 to 10·90, and in Lakhimpur and Cachar 5·85 and 4·32 were their respective rates. In the Goalpara district fevers are reported as being the scourge of the population, no less than 4,840 of the total 5,855 deaths from all causes having been recorded from them. The heavy fever mortality in the Nowgong district, the Civil Surgeon reports, "is easily to be accounted for by the fact of heat and wet acting on the heaps of filth collected in

"villages and producing poisonous vapours, the influence of which the people, in an already enfeebled state, are unable to withstand." The year's experience of Assam fevers tends to show, as the Army Sanitary Commission point out, "that village improvements in water-supply, drainage, cleansing, and jungle clearing, will have to be carried out before we can expect reduction in fever death-rates."

There were 9,865 deaths registered from bowel complaints, showing a death-rate of 2·20 per 1,000 against 7,825 or 2·06 in 1880. As usual, Sibesar recorded more deaths under this head than any other district, which the Sanitary Commissioner states may be accounted for by a better and more progressive system of general death registration than has yet been attained elsewhere in the province.

British
Burma.

It is satisfactory to learn that the registration of vital statistics in British Burma is gradually improving year by year, and that the attention which has been given to the subject in some of the larger towns of the province has resulted in considerable improvement. The actual number of births and deaths registered was greater than in any previous year, but as the ratios for 1881 have been calculated on the census of that year, which showed that the population under registration had increased by 577,859 since the taking of the previous census, they appear less than those of 1880. The number of births registered during 1881 was 73,754 or 19·98 per 1,000 against 72,121 or 23·16 in the previous year, and the excess of births over deaths equalled 3·57 per 1,000.

The year was considered to have been, on the whole, a prosperous and healthy one; food of all kinds was abundant and moderate in price. The total number of deaths registered was 58,136 or 15·75 per 1,000 against 55,185 or 17·72 in 1880. The highest death-rate recorded in the districts of the province was 28·20 at Thayetmyo, and the lowest, 8·88, at Tharawaddy. The increase of 2,951 deaths was mainly due to cholera, the deaths from which were more than double the number of the previous year, namely, 5,239 or 1·42 per 1,000 against 2,638 or 0·85. Excepting in Kyaukpyoo and Sandoway, cholera was present in every district, but the disease was not very widely diffused, for out of 875 circles, in only 97 were deaths reported, and in 222 villages out of 15,451. The epidemic influence of the disease was principally felt at Thayetmyo, Henzada, and Prome, which respectively recorded death-rates of 7·0, 3·88, and 2·41 per 1,000. The total cholera deaths in these three districts numbered 3,197.

There was a considerable falling off in small-pox deaths of which only 1,766 or 0·48 per 1,000, were recorded against 5,402 or 1·73 in 1880. As was the case in the previous year, all the districts were affected but Tavoy and Mergui. Deaths were reported only in 64 of the registration circles and in 87 villages. Children under one year of age contributed 19·36 per cent. of the fatal cases, and those between one and 12 years 47·22 per cent.

The number of deaths attributed to fevers was 27,743 or 7·51 per 1,000 against 27,297 or 8·86 in 1880. The Sanitary Commissioner believes that a large number of deaths which were really due to other causes are ascribed to fever by the ignorant persons upon whom it is necessary chiefly to rely for the collection of these statistics. He is also of opinion that remittent fevers are more common, and that the ordinary ague or intermittent form is not a very fatal disease among the Burmans. Out of 875 registration circles, 564 recorded fever deaths and 1,436 of the 15,451 villages.

Bowel complaints caused 3,808 deaths, equal to 1·03 per 1,000 of the population, being 308 in excess of the number of the previous year.

IV.—JAILS.

Throughout India during 1881 considerable progress was made in promoting the well-being of the prison population. Special attention was given to the dietary of the prisoners, and the experience of another year, Dr. Cunningham states, has shown that the excessive sickness and mortality of previous years in the Bengal jails was due to other causes than that of insufficient and unsuitable food. Out of an average strength of 100,844, which was nearly 6,000 less than that of 1880, the admissions into hospital were 1,214, the daily sick 44, and the deaths 44·03 per 1,000. The admission and sick rates were slightly below those of the previous year, while the mortality was over 4 per 1,000 less.

Sickness and mortality in jails.

The results for the various provinces were as follow :—

PROVINCES, &c.	1881.			1880.		
	Ratio per 1,000 of Average Strength.			Ratio per 1,000 of Average Strength.		
	Admissions.	Daily Sick.	Deaths.	Admissions.	Daily Sick.	Deaths.
Bengal - - - -	1,572	52	65·01	1,542	52	63·82
Madras - - - -	737	28	41·91	851	33	44·95
Bombay - - - -	1,076	34	41·88	1,150	41	45·16
Punjab - - - -	1,519	48	65·15	1,352	42	78·82
North-Western Provinces and Oudh	764	32	23·78	735	31	28·32
Central Provinces - -	790	29	29·80	973	39	60·13
Berar - - - -	825	24	16·51	942	33	35·64
Assam - - - -	1,390	40	43·10	1,173	38	52·46
British Burma - - -	883	36	45·82	870	30	24·89

It will be seen from the above table that there was an increased mortality only in the jails of Bengal and British Burma, the remainder showing an improvement in this respect, and in some cases it was very marked. There is no doubt, however, that, excepting in three provinces, the returns are still much in excess of what they ought to be.

The jail population of Bengal in 1881 was lower than in any year since 1872, and this was attributed principally to the continued prosperity of the country, arising from a succession of good harvests and the cheapness of the principal food grains. An improvement in the water-supply by the provision to all jails of standard filters has had a beneficial effect on the health of the prisoners, and the fortnightly system of weighments has proved very valuable to executive as well as medical officers, the weights at once affording an indication when a change of labour or of diet is desirable. On the whole, however, the health returns show no improvement, for there was a slight increase in the admission-rate from 1,542 per 1,000 of average strength in 1880 to 1,572 in 1881; the daily sick, 52 per 1,000, was the same, while the death-rate rose from 63·82 to 65·01 per 1,000. The statistics of the Bengal jails in fact show that sickness, as gauged by the admission and daily sick rates, was more prevalent in 1881 than in any of the previous 10 years, and that the death-rate was also in excess of any year excepting the years 1878 and 1879. With a view to the discovery of the sources of the continued and increasing sickness the Government of India directed that a special committee of duly qualified officials be convened to inquire into the whole subject. Notwithstanding these unfavourable results, it is satisfactory to learn, as the Inspector-General reports, that the majority of the jails have now become very healthy. The total result has, he states, been very considerably affected by the unhealthiness of the jails of Midnapore, Mymensingh, Chumparun, and Julpigoree. There was, however, a very considerable improvement in the health of the prisoners at Alipore and Presidency jails, and as these two jails contain one-fifth of the entire jail population, the improvement is viewed with satisfaction. In the former of these jails the admission-rate for all classes of prisoners in 1881 was 1,960 per 1,000 of average strength against 2,376 in the previous year, and in the latter jail, 1,841 against 1,992.

The chief causes of sickness and mortality were fevers and bowel complaints, and these combined constituted nearly two-thirds of the total admissions and more than half the deaths. Cholera cases increased from 64 in 1880 to 179, and the deaths from 31 to 81.

This disease was chiefly confined to five jails, Midnapore contributing 33 of the total 81 deaths, Chumparun 20, Moorshedabad and Buxa 6 each, and Pubna 5. Respiratory diseases also were slightly more prevalent than in 1880, the admissions having increased from 920 in 1880 to 942, and the deaths from 106 to 107; while, on the other hand, anemia and debility show a decrease both in admissions and in deaths, the latter having fallen from 124 to 100.

Amongst convicts the hospital admission-rate per 1,000 was 1,696 in 1881 against 1,682 in 1880, the daily sick-rate was 54, exactly the same as in 1880, and the death-rate was 68·6 against 65·4. In 24 jails, containing more than half the convict population, the death-rate was lower than the average, and in 23 jails it was higher.

The following jails show the highest death-rates :—

	Death-rates per 1,000.			Death-rates per 1,000.	
	1881.	1880.		1881.	1880.
Julpigoree - - -	285·5	341·2	Monghyr - - -	94·8	53·0
Baraset - - -	208·4	148·4	Burdwan - - -	90·0	61·1
Chumparun - - -	203·8	83·0	Moorshedabad - - -	86·3	49·7
Dinapore - - -	185·3	181·7	Rajshahye, <i>District and Central</i>	83·5	69·5
Mymensingh - - -	166·8	142·8	Rungpore - - -	83·3	111·0
Beerbhoom - - -	152·9	96·0	Manbhoom - - -	80·9	50·3
Midnapore, <i>District and Central</i>	126·4	72·9	Hooghly - - -	76·6	43·7
Bogra - - -	124·9	104·3	Jessore - - -	74·5	37·3
Darjeeling - - -	122·4	30·7	Mozufferpore - - -	74·5	69·1
Lohardugga - - -	108·7	193·7	Backergunge - - -	73·2	10·4
Nuddea - - -	105·7	70·9	Bankoora - - -	68·6	60·8
Purneah - - -	98·9	120·0			

As in 1880, the highest death-rate was recorded at Julpigoree. Of the 30 deaths which occurred in this jail, 25 were registered in the first five months of the year, and five in the last seven months. The Inspector-General states that the new jail is fast approaching completion, and it is hoped that this will add materially to the healthiness of the prisoners, inasmuch as under the new arrangements they will sleep on beds raised 14 feet above the ground, and thus to some extent be protected from the influence of malaria.

The jails showing the lowest death-rates were as follow :—

	Death-rate per 1,000.			Death-rate per 1,000.	
	1881.	1880.		1881.	1880.
Chittagong - - -	08·8	16·6	Buxar, <i>Central</i> - - -	34·1	41·8
Pooree - - -	11·4	23·9	Patna - - -	39·4	86·0
Furreedpore - - -	14·2	75·6	Maldah - - -	39·8	66·6
Bhagulpore, <i>Central</i> - - -	17·3	31·3	Durbhunga - - -	40·4	43·0
Tipperah - - -	21·4	56·5	Shahabad - - -	43·6	34·1
Singbhoom - - -	21·5	88·1	Bhagulpore, <i>District</i> - - -	44·1	67·8
Dacca, <i>District and Central</i> - - -	22·7	37·8	Pubna - - -	49·7	75·7
Cuttack - - -	23·1	34·4	Presidency, <i>European</i> - - -	55·7	29·0
Presidency, <i>Native</i> - - -	23·4	31·5	Alipore, <i>District and Central</i> - - -	58·2	66·0
Gya - - -	23·7	33·2	Sarun - - -	62·9	47·0
Balasore - - -	25·0	110·8	Russa, <i>Female Jail</i> - - -	63·5	46·6
Noakholly - - -	25·0	18·1	Hazaribagh, <i>District and Central</i>	63·9	23·3

“The fact,” the Inspector General remarks, “that a very large proportion of the prisoners in the Provinces were confined in these jails shows that, on the whole, the sanitary conditions of jail life in some of our most important jails have improved very considerably. It is a matter for congratulation, that 12 jails, in which are included three central jails, should have a mortality of less than 30 per 1,000 during the year.”

Madras.

Since the famine year, 1877, there has been a gradual improvement in the vital statistics of the jails of the Madras Presidency. In that year the mortality reached 176·01 per 1,000, and in 1881 it declined to 41·91, which was 3 per 1,000 less than in the previous year. The death-rate was, however, nearly 10 per 1,000 higher than the

mean of the five years prior to the famine. The admission and daily sick rates were lower than those of 1880. In 22 jails the mortality was under the average, and in 12 the average was exceeded. The highest death-rate was in the Tanjore jail, where it reached 166 per 1,000. Owing to the persistent unhealthiness of this jail, the construction of a new building has at last been sanctioned. Trichinopoly central jail recorded a mortality of 121·36 per 1,000. Of the 125 deaths (comprising nearly a third of the total number of deaths in the jails of the Presidency) which occurred in this jail, 32 were due to cholera out of a total of 33 from this disease, and 80 to dysentery and diarrhœa. A searching inquiry was made regarding the outbreak of cholera at Trichinopoly, and although no absolute conclusion was arrived at, it was suggested that the jail might have become tainted by the foul air wafted from the filth depôt of the municipality "where acres of excreta lay exposed on the surface of the ground without being covered or deposited in pits." The returns of the Salem jail show that there was a marked improvement in the health of the prisoners, the mortality having declined from 116 to 45 per 1,000. There was also a considerable decrease in the mortality in the large central jails at Coimbatore, Vellore, and Rajahmundry, which, it is stated, testifies to the care and attention given to matters connected with the well-being of the prisoners by the authorities.

As regards the convicts, the hospital admissions declined from 9,867 to 7,564, and the deaths from 519 to 419. The greatest number of admissions was due to intermittent fever, dysentery, and diarrhœa. From these last diseases there were 169 deaths, and of cholera there were 33 fatal cases.

There was a considerable decrease in the jail population of the Bombay Presidency in 1881, and with it a proportionate diminution of sickness and mortality. The admissions into hospital were 1,076 per 1,000 against 1,150 in 1880, the daily sick 34 per 1,000 against 41, and the mortality equalled 41·88 per 1,000 against 45·16 in 1880. Compared with the two previous years, 1878 and 1879, the mortality during the year under review, as also that of 1880, was less than one-half. Nearly two-thirds of the total mortality were due to dysentery and diarrhœa, respiratory diseases, fevers, and general debility. Cholera deaths increased from 5 in 1880 to 37 in 1881, and of these 18 occurred in the Surat jail. Bombay.

The returns of the convicts give an admission-rate of 778 per 1,000, a daily sick-rate of 33, and a death-rate of 43 per 1,000, all of which were below those of the previous year.

Several jails showed an increased mortality, especially those of Satara, Ratnagiri, Surat, Dohad, Karachi, Hyderabad, and Shikarpur, where the mortality ranged from 23 to 139 per 1,000. The highest death-rate, 139 per 1,000, was registered in the Surat jail, but nearly one-half was due to cholera. The next highest was 112·80 per 1,000 in the Gokak Gang, which is a satisfactory improvement on 156·38 in 1880. In the Hyderabad jail the death-rate rose from 54 per 1,000 in 1880 to 69 in 1881, the increase being attributed to the prevalence of fever throughout the district during four months of the year, and to chest and bowel complaints. Next to Hyderabad comes Shikarpur jail with a mortality of 63 per 1,000 against 38 in 1880, an increase which is stated to have been due "to the extreme variations in the temperature of the day and night, more especially towards early morning, when a bitterly cold wind often comes." At the suggestion of the medical officer of this jail, straw pillows and jungle-grass sleeping-mats instead of date mats have now been issued for greater warmth.

The sanitary history of the Punjab jails for 1881 shows a greater prevalence of sickness than in the previous year, but of a less fatal nature. Among all classes of prisoners the hospital admission-rate rose from 1,352 per 1,000 in 1880 to 1,519; the daily average sick from 42 to 48, while the death-rate fell from 78·82 in 1880 to 65·15 per 1,000. Considering that in 1879 the mortality exceeded 140 per 1,000, this further reduction is satisfactory, the more so as there was a slight increase in the general mortality of the free population. The death-rate among convicts was 66·7 per 1,000 against 81·4 in 1880; but for a severe outbreak of cholera in the Lahore central jail, where 92 prisoners died from this disease, the mortality would have stood at about 59 per 1,000. The diseases from which the convicts principally suffered were fevers, bowel complaints, respiratory diseases, and cholera. Under the two first of these headings, the admissions to hospital were more numerous than in 1880, while the deaths from these diseases were fewer by 89. Altogether there were 133 cases of cholera, of which 97 proved fatal, whereas in 1880 there was only one cholera death. Punjab.

From respiratory diseases 159 convicts died against 248 in 1880; there was also a very marked decrease in the deaths from ulcers and boils, from 98 in 1880 to 13 in 1881.

The statistics of individual jails show that in 15 the rates of mortality were in excess of those for 1880. In no jail, however, was the terribly high death-rate reached which the Rawalpindi jail recorded in the previous year, namely, over 404 per 1,000. The highest death-rate in 1881 was 265·6 per 1,000 at Dharmasala, which was more than three times as high as that of 1880; the next highest was 201·2 at Rawalpindi, the Lahore and Peshawar jails following with death-rates of 157·4 and 136·9 respectively, against 101·5 and 127·2 in 1880. The high mortality of the Dharmasala jail was due to a severe fever which affected the whole valley. It is reported that the prisoners were received into that jail in such a miserable condition that it was impossible to revive them. Of the 34 deaths in this jail 24 were ascribed to fevers, and 12 of the total number occurred among prisoners who had not been in jail more than two months, and 25 were of less than six months confinement. Every endeavour was made to prevent the spread of disease, but without success, and ultimately the jail was closed until the health of the inmates had been restored. Since the re-opening of the jail it has been healthy. Although the mortality in the Rawalpindi jail was extremely high, the decrease of one-half what it was in 1880 is very satisfactory, and had it not been for the epidemic of fever which extended over from the previous year the decrease would have been still greater. That there has been a considerable improvement in the health of this jail is shown by the fact that 104 of the 131 deaths occurred in the first four months of the year. In the Lahore central jail nearly a third of the mortality resulted from a serious outbreak of cholera, the ravages of which were only checked by the promptitude with which the prisoners were moved into camp. The continuance of typhus fever in Peshawar again told upon the health of that jail. The death-rate was almost identical with that of the previous year; but more than two-thirds of the mortality were from fevers, and occurred in the first five months of the year. After the cessation of this epidemic the jail remained healthy to the close of the year. There was also a very considerable reduction of mortality in the Rupar central jail. In the previous year the death-rate of the jail was 104·17 per 1,000, but in 1881 it declined to 55·74, which was also less than one-fifth of the mortality of 1879. During these three years, the Inspector-General observes, the conditions under which the prisoners existed, as far as prison arrangements go, were the same, and in the face of these facts, he thinks it not unreasonable to attribute the sickness in this and other jails in 1879 to influences independent of prison life. It is satisfactory also to learn that the mortality in the Ferozepore jail, 65·6 per 1,000, was less by one-half what it was in the previous year.

North-
Western
Provinces
and Oudh.

The health of the prisoners in the jails of the North-Western Provinces and Oudh during 1881 was on the whole more satisfactory than in the previous year. Although there was a slight increase of sickness, the rate of mortality was less by about 5 per 1,000 than that of 1880. The ratios per 1,000 of average strength in 1881 were, admissions 764, daily sick 32, and deaths 23·78. Among convicts the admission-rate equalled 797, the daily sick 33, and the death-rate 23·4 per 1,000. In all the jails there was a remarkable exemption from cholera, only two deaths having occurred; on the other hand, bowel complaints were very prevalent, contributing about one-third of the total mortality. No less than 48 per cent. of the deaths occurred among convicts who were in bad or indifferent health on entering the jails, while 22 per cent. of the mortality was due to diseases of no connexion with jail conditions. The prevalence, however, of dysentery and diarrhoea, pneumonia, and cases of sloughing ulcer, the Inspector-General remarks, "still warn us that the sanitary conditions under which the prisoners in certain jails live are not perfect. The medical officers in charge must feel, as I do, that the occurrence of such cases is a stigma upon jail management, and we dare not rest satisfied until the abnormal death-rate in every jail can be proved to arise solely from the reception of old, broken-down, 'poor-house' cases, and not from disease produced in strong men in the prime of life simply because they have become inmates of a jail."

But while the health of the convicts generally was satisfactory, the returns of a few jails witness to a state of things sadly needing attention. At Gorakhpur the mortality reached 139·7 per 1,000, more than a half being due to bowel complaints. This jail, it is stated, is built on a bad site, the garden being flooded by the river Rapti, while a portion of the original building is supposed to have been erected on the site of an old graveyard. A scheme has been sanctioned for sinking in this jail a deep well which will draw water

from a depth at which it will be free from surface impurity. The next highest mortality was at Mirzapore, namely, 70 per 1,000, and the Meerut central prison followed with a ratio of 40. For some time past the condition of this jail has been a source of anxiety, and various schemes for its improvement have from time to time been tried, but still the annual epidemic of malarious fever has recurred. Special attention was being paid to these three jails with a view to their sanitary improvement.

In the jails of the Central Provinces the health of the prisoners appears to have been remarkably good in 1881, for the daily average sick-rate was only 29, or nearly 11 per 1,000 less than that of the previous year, while the death-rate decreased from 60·13 in the previous year to 29·30. The number of hospital admissions was low in all the jails without exception; the daily sick and death-rates were also low in most of them. There was not a single case of cholera during the whole year, and in many jails the mortality from the other principal diseases was less than half what it was in 1880. As regards the convicts, the mortality equalled 30·1 per 1,000, against 61·2 in 1880. Central Provinces.

Of individual jails, Hoshangabad had the highest death-rate, 71·7 per 1,000, then came Raipur with 59·8 and Narsingpur with 55·6, Damoh and Nimar following with ratios of nearly 50 per 1,000 respectively. A marked improvement took place in the health of the convicts in the Jubbulpore and Nagpur central jails, which was attributed to the improvements effected during the year in the drainage and water-supply. In several other jails improvements under these heads were made during the year, especially in the Raipur jail; but in this instance the diminution of sickness was not nearly so great as in Jubbulpore and Nagpur.

The general health of the prisoners in the Berar jails during 1880 appears to have been particularly good. The rates of admission and daily sick were respectively 825 and 24 per 1,000 of average strength against 942 and 33 in 1880, and the death-rate was 16·51 against 35·64. Among convicts the mortality declined from 35·2 in 1880 to 16·1 per 1,000 in the year under notice. Respiratory diseases caused more deaths than any other disease, but they were chiefly confined to the two central jails of Amraoti and Akola, were seven out of the total eight deaths under this head took place. In the previous year there were no cases of cholera in the Berar jails, and in 1880 only three cases occurred, all in the Akola jail, one of which proved fatal. There was more sickness among convicts in the Akola jail than in Amraoti, but the death-rate of the latter was the highest, namely, 17·6 per 1,000, while that of Akola was only 12·9. The highest convict death-rate was 35·3 in the Bassim jail. Berar.

Although the average daily sick-rate in the Assam jails rose from 38 per 1,000 in 1880 to 40 in 1881, the death-rate fell from 53·1 to 43·1, which was a lower ratio than in either of the preceding four years. This improvement is all the more marked because of the total 63 deaths in 1881, cholera was the cause of 12, whereas in the previous year there was only one fatal case from this disease. Of the remaining deaths fevers caused 9, and 23 were ascribed to bowel complaints. Of the total deaths 58, or 42·7 per 1,000 of average strength, were recorded among convicts. Of all the jails in the province that of Gauhati was again the most unhealthy. This jail has long held an unenviable precedence as regards mortality, and in 1880 it contributed 34 of the total deaths, 10 of which were due to cholera. The death-rate of the Gauhati jail was 110·3 per 1,000. In the Dibrugarh jail also the mortality was high, but considerably less than the previous year, the ratio having fallen from 215 to 115 per 1,000. With these two exceptions the general healthiness of the other jails in Assam was satisfactory. In the large jail at Tezpur the health of the prisoners was particularly good, only two deaths having occurred during the year, and these, it is stated, were in a moribund condition on admission. In Sylhet also, with an average population of over 600, there were only 9 deaths, equal to a death-rate of about 16 per 1,000. Assam.

In the jails of British Burma the ratio of sickness among the prisoners was slightly in excess of that of 1880, while the death-rate was nearly twice as high, being 45·82 in 1881, against 24·89 in the previous year. The admission-rate for convicts was 933 per 1,000 of average strength, against 889, and the death-rate 45·1 against 23·4. This increase was due chiefly to the prevalence of epidemics at the Rangoon, Moulmein, Henzada, and Thayetmyo jails. Out of a total of 205 convict deaths, considerably over a half occurred at two jails, Thayetmyo having returned 66 and Moulmein 61. Of the deaths at the latter jail 26 were due to cholera, while at the former there were 51 fatal cases of beri-beri, all of which took place between July and October. Every effort was made British Burma.

to check the ravages of this epidemic, but without success, until, in the month of October, a large number of prisoners were released and the rest were transferred to Moulmein. This measure proved completely successful, for not a single fresh case occurred after the transference of the prisoners. The facts of this outbreak of beri-beri were carefully investigated by a special committee, but nothing was elicited to show that the disease is contagious, "while the fact that it entirely ceased when the convicts were removed elsewhere shows," the Government of India observe, "the vast importance of local conditions as a cause of disease, and the great practical benefit to be derived from a recognition of this truth, and by early removal to another locality."

Fevers caused more sickness than usual during the year, the admissions under this head having increased from 815 in 1880 to 1,180; the excess, however, occurred entirely in the Rangoon jail, where there were 801 fever admissions against 348 in the previous year, but in all there were only ten deaths from these causes. Cholera cases rose from 17 in 1880 to 68 in 1881, and the deaths from 6 to 36, of which 26 took place at Moulmein and 9 at Henzada. There was also an increase in the admissions under dysentery and diarrhoea from 521 in 1880 to 618, and in the deaths from 28 to 47. No death occurred from ulcers in any of the jails during 1881, a fact which is looked upon with satisfaction, being the first year in which this was the case, and showing, the Inspector-General states, "that notwithstanding exceptional disease, the general health of the prisoners was not bad."

V.—VACCINATION.

Further progress was made in vaccination work in Bengal during 1881–82 by an extension of the operations of the Vaccination Establishment, for the first time, to certain tracts in the districts of Purneah, Maldah, Bhagulpore, Mymensingh, and Pooree, together covering a total area of 6,035 square miles, with a population of 2,070,413, of whom 329,813, or 16 per cent., were vaccinated. In addition, portions of Purneah and Darjeeling, and the entire Sonthal Pergunnahs district were made over to licensed vaccinators.

The total number of vaccinations performed by the combined establishments was 1,349,607 against 1,394,312 in 1880–81. In the vaccination circles the operations numbered 1,284,925 against 1,339,012, and in the municipalities and dispensaries 64,882 against 55,300, showing a decrease of 54,087 in the former, and an increase of 9,382 in the latter, or a net decrease of 44,705 cases. The decrease was confined to the Metropolitan, Eastern Bengal, Orissa, and Darjeeling circles, but principally to the Metropolitan, where the falling off was due, it is stated, to certain areas having been repeatedly gone over in previous years by Government vaccinators. The decrement in the other circles was attributed to great sickness among the establishment, to the opposition of the natives, to paucity of vaccinifers, and to other causes. In the Ranchi circle there was an increase of 21,639 operations over the number performed in the previous year, and of 5,994 in the Sonthal Pergunnahs circle.

Of the total vaccinations 1,337,631 were primary cases, 52 per cent. being males and 48 per cent. females, and the ratio of success was 98·39 against 98·23 in 1880. In respect of age, 150,235 children under one year of age were successfully vaccinated, and 831,096 above one and under six years. As was the case in 1880, in no circle was the estimated birth-rate of 30 per 1,000 of population overtaken by the infant vaccination ratio, "nor will this," the Sanitary Commissioner states, "be possible as long as the people do not generally favour early vaccination, and cease from hiding their children at the approach of the vaccinators, and there are no birth registers generally kept up to assist the vaccinators." Of the estimated births in the areas under operation only 11·32 per cent. were vaccinated against 13·94 in 1880. This is the more unsatisfactory, the Lieutenant-Governor points out, because of the total deaths from small-pox 72 per cent. occurred among children.

In the course of their work the Government vaccinators visited 21,929 villages, and inspected 856,628 persons out of the 1,284,925 who had been vaccinated in the different circles. This proportion, compared with the number inspected in the previous year, shows a falling off of 61,421. In addition, sanitary inspections were made by the vaccination officers at a number of villages, but in the majority of the cases the reports submitted were very poor and contained nothing of special value.

The Compulsory Vaccination Act was introduced during the year into the towns of Rungpore, Rampore, Bauleah, Soory, Hooghly and Chinsurah, Pubna, and Bogra, and since the close of the year it had been extended to Howrah. The working of the Act was not attended with any great difficulty, the people in most cases having yielded to simple persuasion, and in the few instances where they proved refractory the issue of a summons was almost always effectual. Generally speaking, vaccination would appear to be making satisfactory progress in Bengal. Opposition, fostered by caste prejudices, is in some places still offered, but as a rule the masses now accept vaccination with readiness and docility, and in some parts it is even sought after and paid for. The law prohibiting inoculation was extended during the year to several towns, and hopes are entertained that before long vaccination will take its place.

In the Madras Presidency 601,222 persons were vaccinated during 1881, being 58,537 less than the number in 1880. Of these 590,875 operations were performed by the special establishment, and 10,347 by medical officers attached to dispensaries. The falling off in the year's work was chiefly due to the great decrease of vaccinations in the Tanjore district, where they fell from 160,979 in 1880 to 44,763, or 116,216 less. A decrease in this district was expected, as in the two previous years almost all the unprotected children were vaccinated by order of the late Collector. The fact, however, that there were 59,770 births in Tanjore during the year, and only 6,712 infants vaccinated, shows that the decrease was greater than it ought to have been. Five other districts also showed a decrease in the number of operations, ranging from over 2,000 to 1,800; still in many instances there was a marked improvement, especially in Coimbatore, where

vaccination had been very backward, and Madura, the operations in the former district having increased to the extent of 12,192, and in the latter to 11,261. In the Malabar district also there were 7,838 more operations performed than in the previous year. The improvement in these three districts was due to the great interest taken in the spread of vaccination by the divisional officers, and the pressure that was brought to bear by them on heads of villages.

The total primary vaccinations numbered 590,681, of which 91·1 per cent. were successful against 88·72 in 1880. Among children under one year of age there were 98,292 successful operations, representing only 13 per cent. of the registered births; and among children between one and under six years the successful primary cases were 260,565.

Notwithstanding that there was a net increase in the municipalities of 11,008 over the vaccinations of the previous year, vaccination work in most municipalities is still very backward. "In municipalities with a comparatively crowded population," the Inspector-General remarks, "which is to a very great extent independent of the influences for persuasion that may be brought to bear on the inhabitants of country villages, compulsory vaccination is more called for than it is in the rural districts . . . My inspections have shown me that under the present so-called voluntary vaccination system it is almost impossible to keep up a supply of good lymph in the smaller municipalities; the consequence is that much of the vaccination done in them is far from being first rate. With a good compulsory Act 99 per cent. of it ought to be first rate; then, and not till then, the people will obtain the full protection from small-pox that vaccination can give."

Bombay.

Vaccination work in the Bombay Presidency was attended with more satisfactory results in 1881-82 than in the previous year. The total number of persons operated upon was 786,092 against 704,984, showing an increase of 81,108, equal to 11·36 per cent. Of these 749,429 were vaccinated by the special establishment, 29,308 by dispensaries, and the remainder were operated on in the army. The primary vaccinations rose from 642,505 in 1880-81 to 729,323, with a percentage of success of 96·52, the highest ratio yet attained in the Presidency, against 95·95. The percentage of success in primary operations was in all districts higher than in the previous year, and ranged from 98·76 in the Cutch circle, to 74·63 at Aden; the ratio of success per 1,000 of total population also rose from 24·60 to 27·54.

According to age, 463,311 children under one year of age were successfully vaccinated, and 223,313 between one and six years. Exclusive of Native states, there were 384,286 surviving infants available for vaccination during the year, and of these 282,480 or 73·51 per cent. were protected from small-pox. Allowing a rate of 31 per 1,000 on the total population as that of infants available for vaccination, 58·48 per cent. were successfully operated on against 49·27 in 1880-81.

In the course of the year the officers of the Vaccination Department occupied 5,289 encampments, travelled 88,941½ miles in 9,218 days, and inspected 343,652 children, thereby showing that out of every 100 persons vaccinated, 43·72 were inspected against 46·27 in the previous year.

The working of the Bombay Compulsory Vaccination Act continued to make satisfactory progress; and through the Karachi Vaccination Act a great improvement had been effected in the quality of the work, although, owing to many unprotected children above one year of age having been operated on in the previous year, there was a falling off in the total results.

Punjab.

Owing to the amalgamation of the Vaccination with the Sanitary Department in the Punjab, which came into operation in October of 1881, the provincial vaccination establishment, by which operations were formerly carried on, was broken up and district establishments were formed and placed under the immediate superintendence and control of the Civil Surgeons, subject to inspection by special officers of the Sanitary Department. Everywhere, it is stated, district authorities cordially adopted the new plan of operations and the scheme promises to work well. Under the new arrangements, the staff of Native Superintendents and Vaccinators was considerably strengthened, and it is expected that the working of the new department in future years will show a marked improvement over the results hitherto obtained. With a view to secure uniformity with the annual vital statistical returns, the compilation of vaccine returns was changed from the official to the calendar year; no useful comparison can therefore be made between the results of the two years 1880 and 1881. In order, however, to preserve uniformity

with other provinces, the Government of India has since ordered that in future the official year is to be continued.

The aggregate number of vaccinations performed by all establishments in the nine months was 316,574 against 483,763 in the preceding 12 months. The primary operations numbered 280,046, of which 94 per cent. were successful.

In the North-Western Provinces and Oudh there was a marked increase in the amount of vaccination work done in 1881-82 compared with previous years. Altogether 767,259 persons were vaccinated against 729,185 in 1880-81. Of primary cases there were 745,925, of which 684,026 or 91·70 per cent. were successful, being the largest number recorded since 1870. This continued progress is most satisfactory, but that there is still plenty of room for improvement is shown by the fact that while 1,779,473 births were registered during the year, only 302,175 children under one year of age were successfully vaccinated. North-Western Provinces and Oudh.

In the first circle, comprising the Meerut and Agra divisions and Tehri, there were 183,746 successful primary vaccinations performed against an average of 170,503 for the five previous years. Eight of the 13 districts in this circle showed an increase, and five a diminution of operations; the most conspicuous among the former being Bulandshahr with an increase of 5,497, and among the latter Saharanpur showed a decrease of 2,368 cases. In previous years vaccination had made steady progress in this district, and it is hoped that the falling off will be peculiar to the year.

In the second circle, comprising the Rohilkhand and Oudh divisions, the successful primary operations numbered 257,572 against an average for the five previous years of 218,409. Out of 22 districts only in three was there a falling off in work, Kumaon showing the greatest, namely, 6,030 cases, Budaun 2,245, and Tarai 382. The decrease in Kumaon is to be regretted since this district has invariably recorded the best results. Satisfactory progress was made in all the districts of Oudh, especially in Rae Bareilly, where the operations increased from a previous five years' average of 2,308 to 17,409, a result due in a great measure to the assistance to the cause rendered by the Deputy Commissioner and Assistant Commissioner.

In the third circle, comprising the Allahabad, Benares, and Jhansi divisions, the successful primary operations were 27,050 in excess of the average of the five previous years. Out of 16 districts only in four was there a falling off in cases, and these do not call for any special notice. Progress was greatest in the Banda and Hamirpur districts, each showing an increase of over 4,000; good results were also obtained in the new district of Ballia.

In the course of the year the Sanitary Commissioner made numerous inspections. Everywhere he states he found that the children bore proofs of recent or antecedent perfect vaccination, and he considers the work of the vaccinators, as now performed, most satisfactory.

Of late years much progress has been made in vaccinating the people of the Central Provinces. During 1881-82 there were 396,782 persons operated upon, against 325,021 in 1880-81, of which 369,651 were the work of the special establishment, and 27,131 that of the dispensaries. The primary cases numbered 387,498, with a percentage of success of 96. Among children under one year of age there were 167,950 successful primary operations, and among those of one and under six years of age there were 169,986. Estimating the annual births at 40 per 1,000, the percentage of infants vaccinated equalled 56·6, against 49·7 in 1880. Central Provinces.

In all districts there was an improvement in work as regards the number of operations performed. Twelve out of the 18 districts in the Provinces showed a considerable increase, the foremost being Raipur, where the operations rose from 13,440 in 1880-81 to 33,425. This number, however, was considered small in proportion to the strength of the staff, and the average number of operations performed by each man was smaller than in many other districts of the Provinces.

Generally speaking, there appears to be no serious opposition on the part of the people to vaccination, and even where it is offered the cases are reported to be generally traceable to the want of tact on the part of vaccinators. In some districts the inhabitants are said to be apathetic, receiving vaccination as a matter of course, though not apparently alive to its benefits.

Notwithstanding the unfavourable attitude of the people of Berar towards vaccination, there was a considerable increase in the number of operations performed during 1881-82. These rose from 85,799 in 1880-81 to 95,420, showing an increase of 9,621, and compared with the results of 1879-80, the number was greater by 23,240. The total primary Berar.

vaccinations performed by all establishments was 95,269, with a percentage of success of 89·8 against 86·7 in 1880.

The highest percentage of success in primary vaccination was obtained in the Wun district, namely, 93·4, and the lowest, 86·7, in Akola. "The standard of success obtained in primary operations in Berar," the Sanitary Commissioner states, "does not compare favourably with that for other provinces in India, though it is better than the results obtained last year. The cause of this cannot be explained other than in the difficulty experienced by the vaccinators in carrying on arm-to-arm vaccinations. Mothers object to take their children from one village to another in order to allow of lymph being taken from the vesicles on the spot, even though offered batta at the rate of two annas a mile; consequently the vaccinators have to resort to the use of stored lymph, with the result of a larger number of failures than if liquid lymph from one arm to another had been used. The persuasive powers of the vaccinators go a very little way towards overcoming the scruples of the people in this direction."

Much progress was, however, made during the year in infantile vaccination, 50,357 children under one year of age having been successfully operated on, and 33,693 children between one and six years old. Reckoning the births at 40 per 1,000 of population, the percentage of infants successfully vaccinated was 47·9.

During the season an attempt was made to extend the benefits of vaccination amongst the hill people of the Melghat. A first-class vaccinator was attached to the camp of Mr. Ballantyne, Deputy Conservator of Forests, an officer of much influence among these primitive and timid people, for the purpose. The vaccinator met with considerable opposition; in some villages he was driven out by the people, and in others they fled at his approach. He succeeded, however, in vaccinating 1,134 persons, equal to 23·2 per 1,000 of the population, and the percentage of success obtained was 87·4.

Assam.

Vaccination work was more successfully carried on in Assam during 1881-2 than in any previous year. The total number of persons vaccinated was 40,309 against 24,167 in 1880-81. Of these 39,128 were primary operations, 34,698 or 88·67 per cent. being successful against a ratio of 87·61 in the previous year. Besides these there were 5,102 primary vaccinations in the tea districts of the province, of which 4,043 proved successful, so that altogether there were 38,741 successful primary operations, or a total percentage of success of 87·5. An increase in the out-turn of work was to be expected, as during the season the agency of vaccination was augmented from 17 vaccinators to 36, and ex-inoculators from 58 to 96. Still, considering the imperfect means of communication in the province, the sparseness of the population, and the prejudices of the people, the improvement is satisfactory.

The local authorities were doing all in their power to further vaccination, and the Chief Commissioner had signified his intention to grant funds for the purpose if assured that the additional expenditure would produce an adequate return in more and better work being done.

British
Burma.

Hitherto the progress of vaccination in British Burma has been very slow. The Burmese being accustomed to inoculation, prefer to adhere to the practice, except when the advantages of vaccination are made very clear to them. Another source of hindrance is reported to be the frequent failure in the quality of lymph supplied from England. In spite of all drawbacks, however, 50,677 operations were performed by the vaccine establishment, being an increase of 5,660 over the number of the previous year, and 39,884 cases were successful, as compared with 34,890. Besides these, 408 vaccinations were performed at the dispensaries, 303 of which were successful. Of children under one year of age, only 7,310 were successfully vaccinated during the year, less than one-tenth of the estimated births.

The inhabitants of the towns were still much opposed to the adoption of the Compulsory Vaccination Act. In the previous year proposals were made by the municipal committees of Rangoon, Akyab, and Tounghoo for the extension of the Act to those towns. At the two former towns, the suggestion aroused considerable opposition among the natives; and as it was found that the arrangements in force at Akyab for vaccinating the public were insufficient to afford complete protection, the enforcement of the Act was postponed pending their completion. It was also proposed not to enforce the Act at Rangoon, until the measure had been considered by the recently elected Municipal Committee; while the Tounghoo municipality withdrew their proposal.

VI.—MEDICAL INSTITUTIONS.

Civil Hospitals and Dispensaries.

The work of reorganising the dispensaries of Bengal was vigorously prosecuted in 1881, and resulted in considerable progress. In many instances inquiry into the financial condition and public usefulness of this class of institution has shown that, while many were perfectly able to stand alone without Government aid, on the other hand many were useless as public charities, were regarded with indifference by the people, and existed solely by means of grants from the State, and chiefly for the benefit of the medical officer in charge and a few well-to-do supporters. This is shown by the fact that on the withdrawal of State aid private subscriptions fell off, followed by the collapse and closure of the dispensary. In some cases, however, where the dispensary had become firmly established, and was widely used and appreciated by the public, subscribers readily came forward on the withdrawal of Government aid, and undertook the management and maintenance of the institution.

The most important step of progressive work in 1881 was the issue of a new code of rules, prescribing a simple and clearly defined system, by which all dispensaries are divided into three classes, viz.: the first or unaided class; the second or aided class; and the third class consisting of institutions supported entirely by Government. The rules also liberate Government from the obligation of establishing or continuing to support institutions which cannot be shown to be necessary or useful as public charities; and Government is no longer bound, as before, to supply medical officers and European drugs and instruments in every case in which a moderate local subscription may be raised.

During the year State aid was withdrawn from 64 mofussil dispensaries, but of these only 16 were closed, private subscribers having undertaken to make good the loss in the remainder. The number of dispensaries open during the year was 247, and before its close 17 had ceased to exist, so that there remained open at the end of the year 231. The total number of persons treated during the year was 970,978, of whom 23,444 were in-patients and 947,534 out-patients; in 1880 the corresponding numbers were 911,662, 23,567, and 888,095 respectively. Among in-patients the death-rate was 158 per 1,000 against 152 in 1880. Dr. Payne, the Surgeon-General of Bengal, writes: "If there be evidence in 1881 of greater usefulness in the dispensaries, it must be sought elsewhere than in the figures, and such tests as can be applied do not give favourable results. Epidemic fever spread over several districts, and cholera was more prevalent than in the previous year. It cannot be denied that if the dispensaries had been in any degree recognised by the people as means of relief in sickness, they would have been in full requisition in 1881, and attendances very largely increased. . . . There can be no doubt that if the figures were true throughout, and the work were genuine, the excess of 1881 would be larger than it has been made to appear. In some places a clear relation to the public health is established, but this is not common in remote dispensaries, although medical subordinates habitually adapt the public health to their figures, when they think the latter will be considered unfavourable to themselves. It must not be forgotten, however, that in 1881 the number of dispensaries was gradually reduced, and this, taken with the more careful scrutiny of records and the widespread sickness, may sanction a hopeful inference from the larger numbers of sick returned."

The total receipts of the dispensaries during the year amounted to 40,194*l.* against 42,655*l.* in 1880, and the sources from which the income was derived were as follow:—

	£
Government - - - - -	10,638
Local, municipal, and other funds - - -	9,638
Interest on investments - - - - -	3,343
Sale of securities and withdrawal of deposits -	1,794
European subscriptions - - - - -	2,002
Native " - - - - -	12,779

The total expenditure was 37,428*l.*, which fell short of that of 1880 by 2,850*l.*

The public health of Calcutta was less satisfactory during 1881 than in the previous year, the town having suffered very severely from an outbreak of cholera. This necessarily affected the hospitals and the death-rates among patients. The number of

deaths in the town from bowel complaints showed an increase compared with 1880 though not over previous years; and while fever was not more fatal than in 1880, it was much less so than in other years. This Surgeon-General Payne considers worthy of attention, inasmuch as in several districts of Bengal there was great fever mortality, especially in the neighbouring district of Nuddea. The evidence of the hospitals, however, in 1881, was not in accord with that of the general town record, for although the total fever cases under treatment was considerably less than in 1880, chiefly from want of space in the Campbell Hospital, the actual number of deaths was considerably in excess, and the death-rate much higher than in 1880. Dr. Payne considers the hospital death-rate is a truer test of the mortality from fever than that to be deduced from town registers, and having in view the epidemic character of the disease in adjoining districts, he inclines to the opinion that fever in Calcutta was more fatal in 1881 than before.

The following statement shows the number of patients treated in each of the medical institutions of Calcutta:—

MEDICAL INSTITUTIONS.	1881.				1880.			
	TOTAL TREATED.			Died per 1,000 of treated.	TOTAL TREATED.			Died per 1,000 of treated.
	In-door.	Out-door.	Total.		In-door.	Out-door.	Total.	
1. Medical College Hospital	5,381	59,085	64,466	129·89	5,069	57,875	62,944	128·58
2. General Hospital	2,863	—	2,863	47·85	3,168	—	3,168	32·19
3. Mayo Hospital and Dispensaries	2,125	183,354	185,479	153·87	2,130	180,267	182,397	145·19
4. Campbell Hospital	6,074	—	6,074	257·4	6,881	—	6,881	280·78
5. Municipal Police Hospital	2,681	—	2,681	15·05	2,723	—	2,723	11·01
Total Calcutta Hospitals	19,124	242,439	261,563	138·31	19,991	238,132	258,123	134·17
6. Howrah General Hospital	1,640	12,511	14,151	192·07	1,567	12,345	14,902	188·18
GRAND TOTAL	20,764	254,950	275,714	142·68	21,548	251,477	273,025	138·17

It will be seen from the above table that there was a slight rise in the general death-rate, from 138 to 142 per 1,000; but this was wholly attributable to the greater prevalence of cholera during 1881, the deaths from this disease having risen from 183 in 1880 to 304. Excluding cholera mortality, the excess disappears, leaving a rate of 131 per 1,000, the same ratio as in the previous year. As already remarked, fever cases were fewer, but they were more fatal, the deaths having increased from 330 in 1880 to 365 in 1881. "This greater fatality," the Surgeon-General observes, "fell chiefly on natives of Calcutta, and did not extend to Howrah, where, however, European cases were more severe, as they were in the General Hospital of Calcutta. This points to sailors as the chief sufferers." From respiratory affections the mortality showed but a slight difference compared with the previous year, and the same is true of dysentery and diarrhœa, which caused 913 deaths against 1,004 in 1880.

As regards the financial condition of the Calcutta hospitals, the income for the year amounted to 42,419 $\frac{1}{2}$ l., of which Government contributed 26,839 $\frac{1}{2}$ l., and the total expenditure, exclusive of the amount invested, was 40,325 $\frac{1}{2}$ l.

Madras.

In the Madras Presidency the number of civil hospitals and dispensaries rose from 218 in 1880 to 255 in 1881, 38 new institutions having been opened and one abolished. The number of patients treated during the year was 1,449,592 against 1,313,304. Of in-patients there were 37,323, a less number by 1,500 than that of the previous year, which the Surgeon-General ascribed to "the general good health of the population and to the favourable conditions of existence as regards food supplies and absence of epidemic disease." On the other hand, there has been a constant rise in the number of out-patients, which is stated to be due to the opening of new institutions (the number being three times as great as in 1877) and the growing popularity of those already established. Among the in-patients there were 2,629 deaths or 70·4 per 1,000 against a death-rate of 83·3 in 1880.

Of the principal diseases under treatment, cholera was remarkably absent for the first nine months of the year. There were, however, indications of an approaching epidemic of the disease in the month of September, the Surgeon-General therefore issued a warning circular calling upon the local authorities to take such active sanitary precautions as were possible to meet it. Altogether 3,310 cases of cholera were under treatment, 180 having occurred among the in-patients, of which 110 proved fatal. Small-pox was less prevalent than in 1880, and fever cases declined from 207,553 to 200,906. "It is worthy of remark," the Surgeon-General states, "that notwithstanding the addition in the last 10 years of 60 new centres of medical relief, the number of fever cases recorded has been steadily diminishing since 1878 and 1879, showing that malarious

“ disorders which were so abundant amongst the population after the famine, had been “ steadily decreasing with regular seasons and normal rainfall.” From bowel complaints there was an increase from 25,967 in 1880 to 28,874, but there was a considerable diminution of mortality under this head among in-patients, the deaths having fallen from 497 to 425. Venereal cases continued to increase, as did also skin diseases and ulcers. Surgical operations were performed during the year to the number of 40,360 against 30,687 in the previous year. The number of major operations was 2,572 against 1,836.

As noted in the last report, the practical administration of dispensaries in the interior, which was formerly in the hands of Deputy Surgeons-General, has now devolved entirely upon Civil Surgeons of districts; and as the duties of inspection and supervision were becoming more and more onerous owing to the great increase in the number of dispensaries, a scheme was under consideration of the Government for affording efficient aid to the Civil Surgeons.

The income of the dispensaries for 1881 was 79,313*l.*, the amount of Government contribution being 27,974*l.* In the previous year the proportion paid by Government was 347*l.* less, the excess being due chiefly to the payment of a proportion of the salaries of medical officers in a greater number of cases. Native donations and subscriptions again fell from 1,498*l.* to 1,272*l.* The total expenditure of the year, including investments, was 78,691*l.*

In the Bombay Presidency there were 41 civil hospitals and 146 dispensaries open in Bombay. 1881 against 43 and 144 respectively in 1880. The total number of medical institutions was therefore the same in both years. The decrease of two in the number of hospitals, and the corresponding increase in the number of dispensaries, were owing to the conversion of the hospitals at Gogha and Alibág into dispensaries. Patients under treatment during the year numbered 1,275,494 against 1,235,455 in 1880. The number of in-door patients in 1881 was 35,679, being an increase of 620 over the previous year. Of this class, 27,073 were cured and 2,913 died, equal to a death-rate of 81 per 1,000, against 74 in 1880.

Over 20 per cent. of the total patients were treated for malarious fevers, which was somewhat less than in 1880. Cholera cases numbered 3,957 against 136 in the previous year, and the admissions from small-pox declined from 115 to 100. For venereal diseases 21,132 patients sought relief, a less number by 2,179 than that of 1880. It is satisfactory to learn that in Bombay Island the admissions on account of these diseases were 717 less than in the previous year. The admissions under dysentery and diarrhoea were slightly more numerous than in 1880, and cases of skin diseases increased from 150,579 to 153,797. Major surgical operations declined from 3,679 to 3,617, while minor cases rose from 62,780 to 67,650.

During his tour of inspection the Surgeon-General visited the three principal hospitals in Bombay, and 23 civil hospitals in different parts of the mofussil. At these he found little to find fault with, and much to be commended in the conduct of the officers whose work came under his personal supervision.

The financial results of the year showed a net income of 93,396*l.* against 93,782*l.* in 1880. The sums contributed by Government amounted to 73,478*l.*, and those from local and municipal funds and miscellaneous receipts to 18,225*l.* The total expenditure was 89,934*l.* against 89,013 in 1880.

The number of dispensaries open in the Punjab during 1881 was 185, or one more Punjab. than in the previous year, and the total number of applicants who sought relief at them was 1,545,808, being 177,379 in excess of 1880. This increase was due chiefly to the great prevalence of fever in certain localities. In the Amritsar district, where, as already stated, a terrible fever raged during the latter part of the year, the number was 55,000 in excess of that registered in 1880. The in-door patients increased from 34,729 in 1880 to 37,011, among whom there were 2,666 deaths, or 72·0 per 1,000, against a ratio of 84·7 in the previous year. In nearly all the principal hospitals and dispensaries more in-door patients were treated than in 1880, the greatest increase occurring at Mayo Hospital (359), Amritsar (160), and Delhi (137). The greatest mortality took place at the Amritsar Civil Hospital, viz., 280·2 per 1,000, Rawalpindi following with 164·7, Delhi with 142·5, and Peshawar with 123·5.

Under almost all diseases there was an increase of patients. Cholera cases rose from 154 in 1880 to 3,234, those due to malarial fever increased to the extent of about 70 per cent., and from respiratory diseases there were 120,905 cases against 115,113; while on the other hand, cases of bowel complaints fell from 72,813 to 62,712, over 10,000 less. Ulcers, as usual, greatly contributed to swell the attendance.

In surgical operations there was a considerable increase, especially in the major cases, which numbered 4,466, or 935 in excess of 1880. This the Lieutenant-Governor viewed with satisfaction as showing the development of surgical proficiency in the ranks of Assistant Surgeons.

The income of the institutions from all sources amounted to 35,272*l.*, being 1,677*l.* more than in the previous year, and the expenditure increased from 32,805*l.* to 34,186*l.*

North-
Western
Provinces
and Oudh.

Eight new dispensaries were open in the North-Western Provinces and Oudh during 1881, leaving 212 at work at the close of the year. The results were highly satisfactory, both in and out-door patients showing a considerable increase compared with the numbers of 1880. The total patients treated numbered 1,591,807 against 1,469,940 in the previous year, of whom 40,977 were in-door, exceeding the number of 1880 by 1,491. The mortality among this class of patients equalled 76·4 per 1,000 against 93·32 in 1880 and 105·8 in 1879.

The increased attendance of patients was most marked under fevers, the cases from which rose from 279,990 in 1880 to 317,416. From syphilis, respiratory diseases, and skin diseases, also, there was an increase of patients, but from cholera the cases fell from 4,482 to 1,253, and spleen diseases from 42,675 to 29,196. A further proof of the usefulness and popularity of these dispensaries is the increase in the number of surgical operations, especially in the major cases, which numbered 8,288, or 639 more than in 1880. Out of these 5,758 were cured and 283 proved fatal. Cataract cases rose from 2,672 to 2,801, of which 1,803 resulted in the restoration of good sight. "A very great amount of good," the Surgeon-General observes, "has thus been done. A visit to one of the hospitals where this operation is regularly practised by an experienced officer would convince the most sceptical as to the great value of this delicate branch of operative surgery." Of minor operations 69,538 were performed, showing an increase of 2,977 over the number of 1880.

The total receipts amounted to 38,774*l.* against 37,595*l.* in 1880, and the expenditure was 36,752*l.* against 36,604*l.*

Central
Provinces.

The number of dispensaries in the Central Provinces remained the same as in 1880, viz. 81. At these 8,159 in-patients sought relief during 1881 and 545,516 out-patients. In the previous year the numbers were 7,882 and 501,479 respectively. Altogether there were 44,314 more cases under treatment than in the previous year, and this increase the Surgeon-General attributed in some measure to the greater unhealthiness of the year in some districts and to the prevalence of cholera; "but as the increase," he states, "has taken place in districts which were pronounced to be healthy, and in which cholera did not prevail to any extent, it may be safely attributed to the greater appreciation of the benefits to be derived by the people; and to the greater exertions of all concerned in the management of these institutions." The death-rate of in-door patients was 96·6 per 1,000 against 101·1 in 1880.

Of the chief diseases under treatment, cholera cases increased from 72 to 4,564, of which 2,786 were attended to in the Julpigoree dispensaries. Cases of malarial fever increased to the number of 8,495, ulcers 7,642, respiratory affections 5,892, dysentery and diarrhoea 3,428, and skin diseases 2,168. A satisfactory increase took place in the surgical operations, the major kind having risen from 398 in 1880 to 567, and the minor from 15,856 to 18,111. There is still, however, the Surgeon-General remarks, a great field open to the surgeon for the exercise of his professional skill in these provinces.

The income for the year, excluding cash balances, was 12,214*l.* against 11,122*l.* in 1880, and the total expenditure 10,401*l.* against 9,956*l.*

Berar.

There was an addition of one new dispensary at Berar to the 35 which were open in the previous year, but it was not in operation until the month of July. The admissions to these numbered 157,098 against 162,709 in 1880, showing a decrease of 5,611. The diminution, however, was solely among out-patients, and was confined entirely to the dispensaries of the Akola and Ellichpur districts, the in-door patients having increased from 2,230 in 1880 to 2,280. The death-rate among the in-patients rose from 36 per 1,000 in 1880 to 38 in 1881.

In the previous year there was only one case of cholera recorded, but in 1881 there were 980; of these 588 were treated in the Akola dispensaries and 139 in those of the Buldana district. Fever cases were less numerous, as were also those of skin and venereal diseases; but, as might be expected with cholera in the province, there was an increase in cases of bowel complaints. The number of operations performed in the

course of the year was 6,708, of which 259 were major. Compared with the numbers of 1880, there was an increase of 20 major and of 209 minor operations.

There was an increased attendance of children at the dispensaries during the year, and this the Surgeon-General considered satisfactory, as tending to prove that the prejudices against European treatment were gradually dying out. Mothers more readily sought the aid of Hospital Assistants in their children's ailments in preference to the village hakims.

The income of the Berar dispensaries for the year was 10,273*l.* against 9,017*l.* in 1880, and the expenditure was 9,262*l.* against 8,497*l.*

No new dispensary was opened in Assam during 1881, the number (23) remaining the same as in the previous year; but the statistics of two missionary dispensaries were added to the returns. A total of 58,001 patients were under treatment against 44,428 in 1880, the in-door patients numbering 2,853 against 2,665. This increase in in-patients is satisfactory, inasmuch as the number for 1880 was 418 less than that of 1879. The Chief Commissioner was of opinion that this falling-off was due to the want of confidence felt by the people in the professional assistance and advice offered them, not a single officer of the rank of Assistant-Surgeon being attached to any dispensary; he therefore brought the matter to the notice of the Deputy Surgeon-General. After carefully considering the subject, that officer has come to the conclusion that, except in very few instances, little or no advantage would be gained by the population at large in the employment of Assistant-Surgeons, as the scope for the work of such officers was very limited. The small attendance of in-patients, he states, is "not so much the want of professional skill as it is the absence of pauperism among the Assamese population, the rarity of diseases requiring surgical skill which fill the dispensaries in other provinces, and, hitherto, the poor and unsuitable accommodation which our poorly endowed dispensaries have afforded."

Of the diseases under treatment there were 149 cases of cholera, a greater number by 59 than in 1880; fever cases increased from 8,380 to 9,481, and bowel complaints fell from 3,726 to 3,524. Skin diseases caused 8,849 admissions, 2,906 of which, or nearly one-third, were treated in the Sylhet district. Surgical operations numbered 2,131, being an increase of 516 over the previous year; the increase, however, was in the minor kind, as the major operations fell from 93 in 1880 to 77.

The income of the Assam dispensaries amounted to 3,771*l.*, and the expenditure to 3,754*l.* against 3,833*l.* and 3,022*l.* respectively in 1880.

Year by year the popularity of the dispensaries in British Burma continues to increase. The number open in 1881 was the same as in the previous year, viz. 27. At these 121,798 patients applied for relief, being 13,016 in excess of the number of 1880. Considering that very few of the medical officers possess more than an elementary knowledge of the Burmese language, the Chief Commissioner thinks the progress made by the dispensaries is remarkable. "Efforts are being made," he states, "to train up natives of the country for civil medical employment in this province, and Civil Surgeons are now required to pass an examination in Burmese. It may be expected that these measures will lead to a wider appreciation of the advantages of the European system of medicine among the Burmese." There was a slight falling off in in-patients from 10,262 in 1880 to 9,886, but the deaths rose from 737 to 912.

Under malarial fever there were 18,632 cases, a less number by 228 than that of 1880. Cholera cases fell from 183 to 136, and small-pox from 184 to 148. The admissions from wounds and injuries also increased from 6,591 to 7,875. During the year 2,870 operations were performed, 116 being major and 2,754 minor, showing a decrease of 331 major and an increase of 851 minor operations over those performed in 1880; still the total increase showed that European surgery was becoming more valued than heretofore.

The year's income of the dispensaries, excluding cash balances, was 14,961*l.*, and the expenditure 13,073*l.*, 44 per cent. being met by provincial funds.

Lock Hospitals.

After considering the report of the Committee specially appointed to inquire into the working of the Contagious Diseases Act in the town and suburbs of Calcutta, the Government of India declined to render the law regarding such diseases more effectual; it was therefore considered hopeless to attempt to work the Act with any effect for the

protection of the civil population, and it was decided to restrict its limits to that part of the town and suburbs inhabited by women who receive visits from soldiers, and to confine its operation to the protection of the military alone. With this change, which took place on the 1st November 1881, the number of registered women immediately fell from 6,565 to 1,961. Throughout the first ten months of the year the Commissioner of Police states that the number of women on the registers had been steadily decreasing from 7,001 to 6,565, while the state of affairs was even less satisfactory than the figures show. Not only is it estimated that at least one-third of the women practising common prostitution were not on the registers, but even the two-thirds that remained under control were only kept on the registers by their ignorance or weakness, or by the belief that the police were possessed of more power of coercing them than they really had. The Commissioner believed, however, that in future the number of women on the register would rather increase than decrease any further, owing to the fear which prostitutes have to receive soldiers without being registered.

The new registrations for the year numbered 131; of these 111 were voluntary, and only 20 were registered after arrest, as against 682 and 57 respectively in 1880. The number of defaulters fell from 4,993 to 4,934, and the percentage of arrests also fell from 83·3 to 64·30, while cases of disease among the defaulters decreased from 12·2 to 9·4, and this notwithstanding the fact that disease was brought into the town extensively during the year by the garrison, and that the port was uncommonly full of shipping. Among the newly-registered women, 29 per cent. were found to be diseased, against 26·9 in 1880.

Since 1870 the serious cases of disease amongst the registered women had been steadily decreasing. In that year the number was 1,708, but in 1880 they had fallen to 83, and in 1881 to 76.

Among the garrison troops venereal cases of all kinds declined from 12·8 per cent. of average strength in 1880 to 8·7 in 1881; but of primary syphilis the cases rose from 1·7 to 3·1 per cent.

The general results of the working of the four cantonment lock hospitals in Bengal during 1881 were on the whole more satisfactory than those of the previous year. In Dinapore particularly a considerable degree of success was obtained, the proportion per 1,000 of cases of venereal disease among the troops being lower than in any of the previous six years. There was also a decrease of disease at Barrackpore; but at Dum Dum and Darjeeling the results were not so favourable as in 1880.

At Dinapore there was a falling off in the total admissions of soldiers into hospital on account of venereal diseases from 244 or 271·5 per 1,000 of strength in 1880 to 146 or 112 per 1,000 in 1881. This great decrease was attributed to three causes, namely, the careful inquiries and examination of women by the new matrons, the increased activity of the police in working the lock-hospital rules, and in the greater readiness shown by brothel-keepers in sending women to hospital, owing to so few being there at the expense of the State. The registered women increased from 74 at the beginning of the year to 78 at its close. Among these there were 183 admissions into hospital against 207 in the previous year. From primary syphilis and gonorrhœa, the admissions among registered women numbered 139, the same as in 1880; a fact which, the Superintendent observes, "further confirms the view that the great decrease in disease among the European troops has been caused by the disease being early detected and brought to hospital for treatment, and not from a smaller amount of disease being present."

The working of the lock hospital rules in the cantonment of Barrackpore during 1881, though showing an improvement compared with the previous year, was nevertheless unsatisfactory. Among the troops there were 87 admissions from venereal diseases or 305·26 per 1,000 of strength against 355·76 in 1880. At the beginning of 1881 there were 89 women on the register, and to these were added 15, but in the course of the year 61 names were removed, leaving only 43 on the rolls at its close. This great diminution was due to a number of kept women being struck off the list. The number of admissions to hospital among the women fell from 159 in 1880 to 96, of which only 28 cases were reported as having been of a specific infecting character, while in 1880 there were 48 such cases.

At Dum Dum there were 139 cases of disease among the troops, equal to 263·93 per 1,000 of strength, against 118 or 270·67 in 1880. Of these 139 cases, 82 were contracted at other stations, chiefly at Calcutta and Benares. During the year 49 women were on the register, but before its close 15 names were removed. On examination 48 women were found to be diseased and were admitted into hospital, being one less than in the previous year. It is satisfactory to learn that the disease from

which the prostitutes and the troops had suffered was of the mildest type. The medical officer feared that the advantages afforded by the new Army Discipline Act to the soldiers for concealing their disease when contracted, would render the Contagious Diseases Act useless, as men might thus come to hospital or not as it suited their convenience. The Lieutenant-Governor, however, instances Dinapore, where, the Surgeon-Major reports, no difficulty was experienced in getting the men to go to hospital of their own accord.

The number of cases of venereal affections among the troops stationed at Darjeeling in 1881 was 68 or 284·5 per 1,000 of strength against 49 or 206·28 in 1880. Of registered women, there were four at the beginning of the year and 10 at its close, and among them there were 18 admissions to hospital. These figures, the Lieutenant-Governor states, "show that unlicensed prostitution prevails very largely. This unfortunately seems "unavoidable under the special circumstances of the depôt. It is quite impossible "to bring the prostitutes in the bazaars at Darjeeling and Jore bungalow under the "Act, and so long as the men have ready access to these, there is little chance of "stamping out or checking the disease."

As in 1880, there were seven military lock hospitals open in the Madras Presidency Madras. in 1881; these were situated at the stations of Bangalore, Bellary, Cannanore, Kamptee, St. Thomas's Mount, Secunderabad, and Wellington. At all these stations, except Secunderabad, there were fewer women on the register than in the previous year, while the number under treatment in hospital was 2,489, or one in excess of 1880, and the average daily sick declined from 189·64 to 154·24. Amongst British troops, the rate of admissions on account of venereal diseases fell from 324·09 per 1,000 of strength in 1880 to 239·47. There was less disease among troops at all the above stations than in the previous year, and it is satisfactory to learn that cases of primary syphilis, the most destructive of all venereal complaints, were less frequent. Bellary and Bangalore headed the list with admission-rates of 397·75 and 316·05 respectively. It appears that these two stations were acquiring a bad pre-eminence, for in 1879 Bangalore had the highest admission-rate of any station, and in 1880 it stood third, while Bellary was second in 1879, and in each of the two following years its admission-rate has been considerably in excess of that of any other station. "Whether the excessive amount of disability from "venereal diseases at these two stations," the Surgeon-General states, "be due to an "unusual prevalence of these amongst the local civil population, or to exceptional "facilities for clandestine prostitution, or to both causes combined, it is impossible to "say. The efficiency or otherwise of registration does not appear to have any uniform "effect on the prevalence of disease. Thus, at all the stations except Secunderabad, "there were fewer names on the roll in 1881 than in 1880, and therefore presumably "more women at large, and yet the foregoing figures show that venereal disease "declined. In fact, this is only what might be expected, seeing that the Contagious "Diseases Act does not in any town practically reach more than a small fraction of "the women actually amenable to its rules."

In the Bombay Presidency the rules for the prevention of venereal disease were Bombay. steadily enforced during 1881, and supervision on the part of the police in detecting illicit prostitution was vigilently exercised. At the 12 stations in which lock hospitals were in operation the total admission-rate for venereal disease was 235·60 per 1,000 against 265·53 in 1880. According to the report of the Surgeon-General, the ratios ranged from 44 per 1,000 of average strength at Karachi and 66 at Aden to 290 at Ahmedabad. The results were not so favourable at several stations where there were no lock hospitals, for at Satara, where, however, the number of European troops was very small, the admission-rate on account of venereal diseases was over 700 per 1,000, and at Kolhapur over 350. In consequence of the great prevalence and acute form of venereal disease among the troops at Satara, and on the alleged ground that the success of lock hospitals in the Bombay Presidency had been generally established, the sanction of the Government of India was solicited to the extension of the Contagious Diseases Act to that station. After duly considering the matter, the Governor-General in Council was not satisfied that the lock hospital system in the cantonments of the Bombay Presidency had proved a success, but considered, on the other hand, that in all Presidencies it had been unsuccessful. He did not think it desirable, therefore, to sanction its extension to Satara.

Amongst the troops stationed in the North-Western Provinces and Oudh in 1881 North-Western Provinces and Oudh. there were 3,340 cases of venereal disease, equal to 231·6 per 1,000 of strength, against

262·8 in 1880, and 240·6, the mean of the preceding five years, and 278·2 the mean ratio of five years previous to the opening of lock-hospitals. The results of the year, therefore, compare favourably with those of previous years. But for the unexpected prevalence of disease at the stations of Moradabad and Sitapur, where the ratios of admissions reached as high as 450·7 and 407·9 respectively, the Sanitary Commissioner is of opinion that the year would have been one of success as regards lock hospital management. In previous years the ratios at these two stations were much more favourable, their means for the five years ending 1880 having been 280·2 and 275·2 per 1,000. Seeing, however, that the average daily strength of the European garrison rose from 9,954 in 1880 to 14,411 in 1881, some credit is due to the general management. In the case of Moradabad, the high ratio is ascribed to the lock hospital being situated in the city, so that no proper control can be exercised over the women; and at Sitapur the prevalence of disease was attributed to the excess indulged in by troops after their return from the Afghan war with an unaccustomed amount of money to spend.

The total number of prostitutes registered in the 18 lock hospitals which were open during the year was 1,756, or 29 less than in 1880, the monthly average on the register being 1,145 against 1,152. During the last four years there had been a persistent falling off in the strength of registered women, which the Sanitary Commissioner thinks is becoming a serious hindrance to the expectation of success in regard to this scheme of disease prevention. The decline in 1881 is looked upon as the more serious because of the rise in the strength of the garrison. The number of women, the Sanitary Commissioner points out, should at least equal a ratio of 10 per cent. of the garrison, consequently there should have been a monthly average of 1,437 instead of 1,152. A greater amount of venereal disease was discovered amongst the registered women than in 1880, the total admissions to hospital being 3,334 against 3,125, and in all stations the ratio of contagious disease prevalence was high.

Central Provinces.

At the four lock hospitals in the Central Provinces, namely, Pachmari, Saugor, Kamptee, and Jubbulpore, the statistics for 1881 show that the working of those at Pachmari and Kamptee were fairly successful, while at Saugor and Jubbulpore there was a great increase of venereal disease among the troops, with a slight increase among the registered women. The average number of prostitutes on the registers during the year was 197, or 14 less than in 1880; the average number attending periodical examinations fell from 173 in 1880 to 153, and the number found diseased and admitted into hospital was 385 against 400.

At Pachmari the ratio of admissions to hospital among the troops per 1,000 of strength was 74·76; at Saugor 140; at Kamptee there was a slight increase in the admissions, but a relative decrease as regards the strength of the troops from 162 per 1,000 in 1880 to 145. The admissions at Jubbulpore rose from 117 or 326 per 1,000 of strength to 232 or 477 per 1,000. The greater number of cases at this station occurred at the beginning of the year, and were contracted chiefly by troops on the line of march, or imported from outside the station. Disease showed a steady decline during the second half of the year.

British Burma.

There are now six lock hospitals in British Burma, but only in the neighbourhood of three, namely, Rangoon, Thayetmyo, and Tounghoo were British troops stationed in 1881. At these the admissions for venereal diseases of all forms numbered 331, or 121 per 1,000 of an average strength of 2,646 against 306 or 115 per 1,000 in 1880. The ratio of cases contracted in the province was 102 per 1,000 of strength against 86 in the previous year. At Rangoon there was a satisfactory decrease both in the amount and in the virulence of the disease, the admissions having declined from 153 or 217 per 1,000 to 108 or 164 per 1,000, while at Thayetmyo they rose from 115 or 82·50 per 1,000 to 140 or 92·20, and at Tounghoo from 38 or 81·37 per 1,000 to 83 or 176·55. This great increase at the latter station was attributed partly to the escape of two diseased women from the lock hospital in November, and who evaded arrest for a period of 20 days. In the following month the number of cases of primary syphilis among the troops was greater than the total for the previous 11 months.

The total number of women whose names were borne on the registers of the several lock hospitals was 911 against 1,048 in 1880, the cases of disease among them being 1,218 against 1,454. At all the hospitals, with the exception of Tounghoo, there was a decrease in the admissions, but there the cases under treatment rose from 21 to 73; the greater number, however, were of diseases which were not specific.

Lunatic Asylums.

In 1876 orders were issued by the Government of India restricting the admission of ^{Bengal.} patients into lunatic asylums to criminal lunatics and to such others as were absolutely dangerous, or were without friends or resources, and yet required medical treatment for their recovery. Since that year there has been a steady decline in the number of patients confined in the Bengal asylums, and it would seem that there is little hope of further reduction. The statistics of the three years ending 1881 certainly point to this conclusion, for though the fresh admissions fell from 196 in 1878 to 173 in 1879, there was an increase of 10 in 1880 and a further increase of five in 1881. The new admissions for the year under review numbered 188, and the re-admissions 25, making a total of 213 admissions during 1881.

The aggregate number of persons treated for insanity at the five asylums in Bengal in 1881 was 1,094, less by 10 than the number of the previous year. Of these 93 were discharged on recovery against 73 in 1880, the increase being attributed to the large number of persons admitted who were suffering from acute or curable mania. The most frequent cause of insanity amongst those admitted was excessive use of intoxicating liquors or drugs, as is shown by the fact that out of 111 admissions in which the cause of insanity was known, 66 were said to be due to ganja, 3 to bhang or charas, 13 to spirits, and 2 to opium.

Since 1878 there has been a gradual and satisfactory improvement in the health of the lunatics, the number under treatment in hospital having fallen from 784 in that year to 417 in 1881, which was a less number by 99 than that of 1880. Not a single case of cholera occurred in any of the asylums, while in the previous year there were 12; admissions from dysentery and diarrhoea also fell from 178 to 111, and anemia and debility from 47 to 25. The decrease under this last head would seem to bear out the remarks of the Surgeon-General in his report for 1880, wherein he stated "it is probable" that under the regular practice of *post-mortem* examinations the virgin names of "debility and anemia will appear less frequently in asylum returns." On the other hand, fever cases rose from 123 in 1880 to 136, the principal increase having occurred in the Patna and Dacca asylums, where there were respectively 66 and 49 admissions from this cause against 37 and 30 in 1880. Cases of phthisis rose from 34 to 37 and of pneumonia from 5 to 9.

As regards mortality in the asylums, the number of deaths fell from 109 or 12·3 per cent. of the daily average strength in 1880 to 84 or 9·6 per cent., which was the lowest number in the decade excepting that of 1877. Phthisis caused more deaths than any other disease, namely, 28, dysentery and diarrhoea following with 20, and anemia with 5. As usual, the deaths were most numerous in the Dullunda asylum, where they numbered 33, Patna coming next with 30. The heavy mortality in these two asylums was attributed partly to the condition in which lunatics were received during the year and partly to the larger proportion of maniacs to the total number of patients in them, maniacal affections being considered more fatal than any other form of insanity.

Of criminal lunatics there were 380 under treatment during the year against 369 in 1880, the primary admissions numbering 72. At the close of the year the number was reduced to 297, 24 having died and 59 having been discharged or transferred to their friends.

The results of the working of the three lunatic asylums in the Madras Presidency for ^{Madras.} 1881 show that there were 175 civil patients admitted during that year, which, added to the number remaining from the previous year, brought the total up to 538, against 512. Besides these 28 criminal lunatics were admitted during the year against 33 in 1880, making a total of this class of 91 under treatment. Of the total cases 131 were said to have originated from physical and 57 from moral causes, a large proportion of the former being attributed to the abuse of narcotics. Cures were effected to the number of 66, and 24 patients were transferred to their friends.

The general health of the inmates of the asylums was on the whole satisfactory. The admissions into hospital declined from 302 to 261, and the daily average sick from 38·82 to 21·57. Altogether there were 34 deaths, equal to 9 per cent. of the daily average strength, as against 45 or 12·81 in 1881. Of the 34 deaths, 11 were ascribed to dysentery and diarrhoea and 6 to phthisis. The mortality was highest in the Waltair Asylum, being in the ratio 34·5 per cent. to daily strength; in the Madras and Calicut Asylums the death-rate was only 6·01 and 8·3 per cent. respectively. The heavy death-rate at Waltair, though lower by 5 per cent. than that of the previous year, was again attributed by the Medical Officer to the fact that only a small number of hopeless and incurable cases were detained in the asylum. As, however, the average rate since 1878-9 was nearly double that of the seven preceding years the Madras

Government ordered that a strict inquiry should be instituted with a view to ascertain whether in addition to the cause assigned there were special local causes at work.

Bombay.

At the five lunatic asylums in the Bombay Presidency, there were 252 new admissions during 1881, and five re-admissions, making a total of 903 persons under treatment against 913 in 1880. Of these 223 were discharged during the year, 67 as cured, and 154 for transference to their friends. Of the total cases, the alleged cause of insanity was given in 416, of which 350 were ascribed to physical and 66 to moral causes. Among the former 178 were said to have been due to intoxicating liquors and drugs, while of the latter 45 were due to grief.

Though not so good as in the previous year, the general health of the inmates of the asylums was satisfactory, excepting at Ahmedabad, where cholera and fever were very prevalent. There were 327 admissions into hospital against 275 in 1880. Malarious fevers were the chief causes of sickness, the cases numbering 121; bowel complaints came next with 51, debility following with 36, and bronchitis and cholera with 14 and 12 cases respectively. The total number of deaths was 53 or 8·4 per cent. of the daily average strength against 37 or 6 per cent. in 1880. Six of the deaths were due to cholera, all having occurred at Ahmedabad; 11 deaths were recorded as being due to diarrhoea, the same number to debility, and 5 to malarious fevers.

At the end of 1880 there remained 90 criminal lunatics in the asylums, these were increased during the year to 110 by 20 new admissions. Of the total number, which was 5 in excess of the previous year, 9 died and 8 were cured.

Punjab.

The new admissions into the two lunatic asylums of the Punjab rose from 87 in 1880 to 132, increasing the number of patients under treatment in 1881 to 438, of whom 333 were confined at Lahore and 105 at Delhi. Of the primary admissions, 14 were criminal lunatics, and at the end of the year there were 39 of this class in confinement. As regards the health of the inmates of these two asylums there was a slight increase of sickness with a considerable excess of mortality. The death-rate per cent. of daily average strength was nearly the same in both asylums, being 14·60 at Lahore, and 14·98 at Delhi. The chief death cause at Lahore was cholera, which accounted for 13 out of the total 35 deaths. But for this outbreak of cholera the death-rate of this asylum would have compared favourably with former years. At Delhi the chief causes of mortality were diarrhoea and pneumonia, each of which contributed 4 to the total 11 deaths.

North-Western Provinces and Oudh.

The population of the four lunatic asylums in the North-Western Provinces and Oudh for 1881 was 1,154 against 1,093 in 1880. The number admitted during the year was 329, and of these 144 were reported to have become insane from physical, and 19 from moral causes. Before the close of the year 302 persons were struck off the registers, 142 having been discharged as cured, 58 were made over to their friends, and 73 died. In the previous year 76 deaths were registered. The largest number of deaths (28) occurred at the Bareilly Asylum, but the rate of mortality was highest at Agra, namely, 9·44 per cent., and was attributed to the want of a sufficient supply of anti-scorbutic vegetables and fruits. At the Bareilly, Benares, and Lucknow Asylums great care was taken to secure at all time the best vegetables in season, which, supplemented with lime-juice and fruits, proved of great benefit to the health of the inmates.

During the three years ending 1880 there had been a steady decline in the number of criminal lunatics, but in 1881 they began to increase again, rising from 168 in 1880 to 202.

Central Provinces.

At the two lunatic asylums in the Central Provinces, namely, Nagpur and Jubbulpore, the number of patients under treatment in 1881 was 128 and 154 respectively. At Nagpur there were 15 fresh admissions during the year, and 29 at Jubbulpore, and at the former 7 patients were discharged during the year as cured, and 10 at the latter. At both institutions there was a considerable increase in sickness, but especially at Nagpur, where there were 136 admissions to hospital, 56 of which were due to fevers. At Jubbulpore the admissions to hospital numbered 86, fevers accounting for 41. Mortality was heaviest at Jubbulpore, where the deaths rose from 7 in 1880 to 9, 5 of whom, it is stated, were helpless idiots, and had been a long time in the asylum. Nagpur Asylum recorded 6 deaths against 9 in the previous year.

Berar.

The statistics of the Amraoti Lunatic Asylum for 1881 show that the population rose from 31 in 1880 to 34, six being primary admissions, and three re-admissions. The

health of the inmates was very satisfactory, the daily average sick being 1·39 against 2·14 in 1880 and 3·02 in 1879. There were, however, two deaths, while in the previous year the asylum was free from mortality. Of the total cases, the cause of insanity was known only in 16, of which 11 were ascribed to intoxicating liquors and drugs, 3 to epilepsy, and 2 to grief. The number of criminal lunatics under treatment was 9 against 8 in the previous year.

At the Tezpur Lunatic Asylum in Assam there were, during 1881, 70 patients under treatment, being a larger number than in any previous year. Of an average population of 51·64, there were 73 admissions into hospital against 33 admissions out of a population of 45·85 in 1880. The chief causes of sickness were fevers, lung diseases, and bowel complaints. No less than 38 of the admissions to hospital took place during the last three months of the year, and were due chiefly to fever and diseases of the respiratory system. Seven deaths occurred in the course of the year, being the same number as in 1880, of these 5 were attributed to chest affections. The death-rate was 13·55 per cent. of the daily average strength, against 15·26 in the previous year. Of the 7 deaths, 3 were of persons admitted during the year in a broken-down state of health, the remaining 4 were inmates of previous years with debilitated and diseased constitutions. Assam.

The total number of persons treated for insanity in the Rangoon Lunatic Asylum during 1881 was 224, or one less than in the previous year. Of these, 48 were new admissions, 11 of whom owed their insanity to physical, and 16 to moral causes. The health of the population was not so satisfactory as in previous years, entirely owing to a severe outbreak of cholera. Admissions to hospital increased from 57 in 1880 to 89, and the deaths from 19 to 25. Cholera was the cause of 31 of the admissions and 12 of the deaths. For the first 10 months of the year the general health of the patients was satisfactory, and the deaths up to the 18th of November numbered only 12. On that date, however, the first cholera case occurred, and notwithstanding that every precaution was taken to guard against the spreading of the disease, not a single ward escaped. In consequence of this epidemic the Superintendent submitted certain proposals for improving the sanitary condition of the asylum, which were approved by the Chief Commissioner. In the previous year cholera was absent from the asylum. But for its appearance in 1881 the Superintendent considered that in no period of its history had the asylum shown so well. British
Burma.

Medical Schools.

Medical students in Bengal again decreased in number during 1881-82. At the Calcutta Medical College the number of students declined from 123 in 1880-81 to 117. During the session 115 students were admitted, and at its close 15 passed the M.B. or L.M.S. examination, and 14 hospital apprentices passed and left for regimental duties; of the remainder, 84 ceased to attend, five hospital apprentices were discharged, and one resigned the service. Bengal.

In the four vernacular medical schools the pupils declined from 503 to 310. The largest reduction occurred in the Sealdah or Campbell Medical School, where, on account of the higher standard of admission enforced for the purpose of securing a better class of practitioners, the number of pupils fell from 244 to 149. Of 35 second-year students at this school who presented themselves for examination all but four passed; and of 47 students at the final examination, 44 or over 93 per cent. were successful against 76 per cent. in the previous year. The Dacca College showed an increase from 87 to 97 in the number of students, and the result of the examinations show that 14 out of 18 third-year class students passed and obtained certificates. The number of students on the rolls of the Temple Medical School during the session was 131, of whom three were military and the rest civil. Of the former, two passed the junior examination; and of the latter, 19 passed the final, and 32 the junior examination. At the Cuttack Medical School there were 30 students against 26 in the previous session. Eleven candidates out of 13 passed for the first diploma, and 5 out of 7 passed for the final diploma. There were again great fluctuations in the number of paying students at these colleges, but as henceforth the fees were to be paid in advance, more regular attendance was anticipated.

On the opening of the session of 1881-82, the number of students in the three departments of the Madras Medical College aggregated 226, besides six ladies. On the whole the behaviour of the students was satisfactory, and the progress made by them highly Madras.

commendatory, as the results of the examinations testify. In the first or senior department there were 82 students against 62 in the previous session. Of these, 20 presented themselves for examination and only two failed. In this department one lady was qualifying for the degree of Licentiate of Medicine and Surgery, and made considerable progress in her studies, having obtained 72 per cent. of aggregate marks at the Professor's examinations. In the second department, consisting of three classes, there were 67 students against 80 in the previous year. Of these, 31 in the third-year class or final year of study, appeared for examination in the apothecary trade, and 29 were pronounced qualified for the public service. The second and first year classes were, with few exceptions, making satisfactory progress. Five lady students were on the rolls of the first-year class of this department qualifying for certificates as medical practitioners, and obtained an average of 73 per cent. of the total marks at the examinations held at the close of the year. In the junior department the number of students increased from 46 in the session of 1880-81 to 77. There were 40 pupils in the third-year class, 30 of whom at the final examination were considered competent to enter upon their duties as hospital assistants. Favourable mention was made of most of the students in the other two classes of this department.

Bombay.

At the Grant Medical College in Bombay there were 283 students on the rolls, being one more than in the previous year. The results of the session were very satisfactory. Five students obtained certificates with the view of prosecuting their studies in England, 23 out of 40 students passed the first L.M. and S. examinations, 4 being in the first and 19 in the second class. In the hospital apprentice class 9 candidates passed the final examination; and 2 female students of midwifery, on finishing their course of study, were found duly qualified for the usual certificates.

In the Medical Schools at Poona and Ahmedabad satisfactory progress was made by the students, of whom there were 60 and 57 respectively on the rolls. The Poona School was called upon during the year for a second time to relieve a sudden strain on the subordinate medical department, and 15 students were found qualified to enter the service. The question of increasing the number of medical subordinates to meet urgent departmental wants was under the consideration of the Government.

The new medical school at Hyderabad was established in July 1881, and its progress is reported to be most encouraging. The Surgeon-General had little doubt that in time the school would take just as high a place as the institutions at Poona and Ahmedabad. The school meets a great want, and will, he says, "in time help the department out of the difficulty which is at present felt in supplying the Province of Sind with properly qualified subordinates."

Central Provinces.

In the Nagpur Medical School, Central Provinces, there were 29 students under instruction during the session of 1881-82. Of these 3 were in their third year, 13 in their second, and 13 in their first year of study. All the third-year students passed out of the school creditably, while the remaining students, who had been chosen from the successful competitors at the High School examinations, worked with great assiduity and gained excellent marks at the examinations. The session therefore closed with 26 students on the rolls of the school, but 10 other probationers were to have been added in June 1882.

VII.—SANITATION.

It was stated in last year's report that the amalgamation of the Vaccination with the Sanitary Department had been carried out in all the provinces of India excepting the Punjab. In October of 1881 that province also was brought under the arrangement, the amalgamation of the two departments throughout the whole of British India is thus completed. Every endeavour is now being made to make these new establishments as useful as possible in sanitary work. With this view, vaccinators were being instructed in the elements of sanitary science, a knowledge of which would enable them to assist greatly in the diffusion of sanitary information among the people, especially the villagers. The system of local self-government which has lately been inaugurated, and which is being generally introduced into all the provinces of India, will, it is anticipated, also have a decided influence on sanitary progress.

Organisation
of Health
Departments.

On the whole, satisfactory progress was made in improving the sanitary condition of the town of Calcutta during 1881. Much attention was given by the Commissioners to road-making, bustee improvements, and filling in of noxious tanks, and, notwithstanding the difficulties with which these matters are beset, progress was apparent in almost every direction. But the most urgent of all the needs of the town is the extension of the water-supply. During the year the supply was again found to be very insufficient, while the demand continued to increase, as is shown by the fact that 637 new connexions were made in the course of the year, making a total of 13,386 premises now connected. The matter was receiving the attention of the Commissioners, and various measures were in course of adoption. The deficiency, however, would to some extent be met when the arrangements for increasing the unfiltered supply were completed, which it was hoped would be some time in 1883, as by these means all the filtered water used for watering the streets, &c., would be set free. It is estimated that a million or more gallons a day of filtered water will then be added to the present consumption to meet the growing wants of the town. The drainage system of Calcutta was fast approaching completion, and the Municipal Committee hoped that by the end of 1883 the work would be brought to a conclusion. In the course of 1881, 14·15 miles of drainage were finished, leaving only 21·12 miles to complete the work. "Four or five years more of such improvements as have been carried out in 1881," it is stated in the Commissioners' Report, "will make a very perceptible difference in the northern part of the town; at the same time, unless these measures are supplemented by others, the Commissioners are well aware that they will be abortive."

Bengal.

With the view of further improving the sanitary condition of the port of Calcutta, measures have been adopted to prevent the defilement by coolies of that part of the Calcutta foreshore extending from Matiabruj Ghât down to the upper boundary of the Bengal Cotton Mills premises. Owners of lands on the river-side have been warned to prevent the commission of nuisances on their lands, and notices have been issued to owners of premises where kerosine oil, cargoes, or straw was discharged, to provide common latrines for persons resorting to their premises; in the meantime temporary latrines have been provided and arrangements made for cleaning them, and the Commissioner of Police has been requested to station constables to prevent the committal of nuisances. A large latrine has been constructed on the edge of the river bank by the East Indian Railway Company, but no extension of latrine accommodation had been made by the Port Commissioners or the Calcutta Corporation.

The proportion of municipal income expended on sanitary works in Bengal during the year was 24 per cent. of a total income of 279,121*l.* against 27 per cent. of income in 1880. Generally speaking, fair progress was made in sanitation in the towns and districts, particularly with regard to drainage, the cleansings of the abominable private privies by the municipal mehters instead of private mehters, and the construction, metalling, and improvement of roads. Among the principal works that were finished or in progress were the following.

In the suburbs of Calcutta great improvements in bustees have been carried out, and a scheme for the supply of water has been approved. The Government had offered a grant of Rs. 1,70,000 to the suburban municipality for the carrying out of the work, providing it was commenced in January of 1883. "Till the great aggregations of people

"round Calcutta are placed in good sanitary condition," the Sanitary Commissioner says, "it can never be hoped that very material improvement will take place in general health."

The Eden or Jujuti Canal project, by which a supply of good water was made available for the districts of Burdwan and Hooghly, and the country through which the canal passes, was completed in December. The Burdwan water-supply scheme, for supplying the town with filtered water from the Damuda through distributary pipes, was matured, and a loan, repayable by levying a water-rate on the holdings that will be benefited by the measure, was to be applied for. It was in contemplation also to re-open the old Gangoor river in the Burdwan district, by which a large tract of country will be drained and supplied with good water.

In Manbhum the Govindpore lake has been made by private subscription, and will be the means of providing sufficient good water to a large number of people residing in its locality, and to travellers passing along the Grand Trunk Road.

At Dinapore the main drainage channel with its subsidiary drains was completed, the entire cost amounting to 5,734*l*. At Rungpore also the drainage of the town was further improved by constructing surface drains and joining them to the main drainage.

In Dacca many sanitary improvements were effected. New drains were constructed, and a complete drainage scheme was under consideration. It had also been determined to extend the waterworks to the whole town, and under the orders of the Lieutenant-Governor it was decided to improve the sanitary condition of, and to convert into a civil station, the important but very filthy commercial town of Naraingunge.

Appreciable improvements were carried out in the town of Darjeeling and several other districts, while district officers and others in many cases had been especially instrumental in promoting sanitation. In a number of towns, including, as the Army Sanitary Commission point out, the great pilgrim cholera centre, Poori, the Bengal Municipal Act was extended, and the Act empowering the Commissioners of first-class municipalities to control public and private latrines was also brought into operation in several places for the first time.

In connexion with the scheme of local self-government the Lieutenant-Governor had directed that the municipalities, stations, and unions in Bengal should be relieved of all police charges from the financial year 1882-83. "The effect of these orders," the Sanitary Commissioner says, "will therefore be to give them a grant of three and a half lacs of rupees per annum; and the intention of this concession is, that this amount shall be expended on sanitation, and on other works of improvement, and on education—the last subject has been, however, postponed for future consideration. The great drawback to progress in sanitation, viz. want of funds, has thus to a material extent been removed, and it is hoped that the municipalities will now be enabled to carry out some of the many sanitary and other improvements which are urgently called for in many towns."

Madras.

Considerable attention appears to have been given to sanitary work in the Madras municipality during 1881. In the work of diverting sewage from the river Cooum, wherever it was possible land was taken near the outfalls, and the sewage from the various sewers led into wells on the land obtained. In the course of the year the sewage from eight separate sewers which flowed into the river was diverted in this way, and the sewage was being profitably disposed of over the lands from which large crops of grass are obtained. "In another year or two," the President observes, "it is to be hoped that the Cooum will be freed from all sewage except what is brought in during heavy rains, and its general condition greatly purified."

Mr. Jones's scheme for the drainage of Black Town has been accepted by the Madras Government, and sanction was given for the raising of a loan of 10,000*l*. in order to commence operations. Towards the extension of water-supply the Commissioners determined to complete as far as possible the distribution of the Red Hills water throughout so much of the area of the city as was intended to be supplied, and for this purpose they had sanctioned the raising of a loan of 25,000*l*., a sum which it was estimated would complete the work, and which had also received the sanction of Government.

Conservancy arrangements were well attended to, and in many places great improvements effected. In the Tinnevely Settlement and Nagatha Covil Parcherry, which were formerly the most loathsome and filthy quarters of the town, huts were removed, and lanes and streets thoroughly opened to sanitation, a step which had greatly conduced to the health of the people during the recent cholera epidemic. Owing to the outbreak of cholera the conservancy staff had also been considerably strengthened, and overseers of wards had been specially instructed to give redoubled energy in sanitation and conservancy, especially to inspection, and much good had already resulted.

Although no work of any great magnitude was undertaken in the Madras Presidency during 1881, sanitary work generally appears to have been fairly well prosecuted. Conservancy arrangements were considered on the whole satisfactory, but in matters of water-supply and house sanitation there was still much need for improvement. "Progress in this direction, however," the Governor remarks, "depends so much upon a change in many of the native habits and ideas, that much advance is to be looked for only as an intelligent apprehension of the importance of these things spreads among the people." Out of a total municipal income of 147,323*l.*, 31 per cent. was allotted for sanitary purposes, but of this amount a little over one-fourth remained unutilised, and only in three instances was the full allotment expended. In future, Presidents were to be held responsible that the budgeted grants were not allowed to lapse without the express sanction of Government.

In local fund circles the total available income (one-third land cess) was 135,140*l.* Of this sum 38,696*l.* were allotted for sanitary purposes, of which, however, less than two-thirds were so expended. There would seem to be a great want of conservancy arrangements in the towns and villages of some circles. "Many towns and villages," the Sanitary Commissioner states, "are left to take care of themselves at the mercy of the rural population. These people cannot be made to understand what filth and dirt mean, and are so ignorant of the rudiments of sanitation, that they violate its very law every day of their lives, by polluting the water-supply in every possible manner, defiling village sites, waste lands, corners of bye-lanes and streets, and tank-banks with human excrement, and by accumulating heaps of manure, and other offensive and noxious matters injurious to public health in and around their dwellings." To remedy this state of things, he strongly urges that legal power should be given to district authorities to enforce the observance of simple rules of sanitation, that more professional supervision should be introduced, and that villages should be more frequently inspected by some responsible officers, who should be empowered to deal with not only external but internal dirt also. In regard to improvements in villages, the Army Sanitary Commission again recommend that existing methods of dealing with them, "such as they are, should be better systematised, and the village officials called on to give practical effect to powers which they appear to have already. And we hope," they say, "with the Government of Madras, that 'in local fund circles the Government trust that the several boards will soon see their way to making larger sanitary grants than they do at present, especially for the improvement of village sites and of the water-supply. As it is, the allotments, the Government regret to notice, were not fully utilised. In no circle can it with truth be pretended that objects were wanting on which the money might be usefully expended. The Board of Revenue are requested to pay special attention to this matter.'"

The results of the fairs and festivals held in the Madras Presidency between September 1881 and December 1882 show that with very few exceptions the sanitary and other arrangements were satisfactory, and that the great majority were exempt from cholera. The Army Sanitary Commission notice that the practical lesson to be learnt from these festivals is that camping outside and away from the crowded town populations should be the rule, and that considerable increase of the conservancy staff and arrangements are required.

Sanitary arrangements at Madras festivals.

The new main sewer of Bombay city, extending from Frere Road, near Carnac Bunder, to Love Grove, near the new pumping station, a distance of $4\frac{1}{4}$ miles, was completed by the 1st June 1881. The outfall sewer was also completed, but owing to unusually severe weather the rubble and concrete covering of the sea end for a length of 192 feet was displaced, but before the close of the year the greater part was repaired. The foundations of the new pumping station at Love Grove were finished during the year, and it was anticipated that the new engines would shortly be at work. Unfortunately, slow progress was made with pipe sewer work in connexion with the main sewer, which caused great inconvenience to the public. At the end of the year $16\frac{1}{4}$ miles of pipe out of $23\frac{3}{4}$ miles had been laid.

Bombay.

Several important surveys in connexion with the main and outfall sewers were under consideration, the chief of which were—

1. The survey and estimates for house connexion in the first portion of the sewage scheme.
2. The connexion of the new sewerage system to the district of Kamathipura, with house connexions complete.
3. The interception of the present outfalls in Back Bay.

4. A new and comprehensive surface drainage scheme, comprising several new drains and a flood reservoir on the flats.

As regards water-supply, the most important work carried out was the raising of the dams of the Tulsi Lake by 6 feet. It was estimated that this would yield an additional storage of 480 million gallons. In consequence, however, of the comparatively small rainfall, the lake did not fill up its waste weir level, and the addition to the storage was consequently only 234 million gallons. But slight progress was made with the Bhandawara reservoir, a little more than one-half of the work which it was expected would have been completed remaining unfinished. To a certain extent the work has been attended with unexpected difficulties, "but with every allowance for these," the Municipal Commissioner observes, "the slow progress made by the contractors cannot be justified, and as it is of the greatest importance that the reservoir should be available for use as soon as possible; it will now be a question whether the contract must not be taken out of their hands."

Conservancy work received considerable attention. Progress was made in the reclamation of flats, in the improvement, construction, and regulation of cattle-sheds, and in regulation of unwholesome trades, and prevention of nuisances. The year's experience shows, as the Army Sanitary Commission remark, that real progress is being made in rooting out the epidemic disease causes in the city, but the Commission consider that more progress ought to have been made with the drainage, considering the time that has elapsed since the question was first discussed, and that the water-supply must be increased.

In the Bombay Presidency the total income of the municipalities, exclusive of Bombay city, was 256,979*l.*, of which 63,371*l.* were expended on conservancy arrangements. In several towns important improvements were carried out in waterworks, and much attention was devoted to the cleansing and repairing of drains, to the erection and repairing of latrines, besides other minor sanitary matters. Of late years good progress has been made in improving the sanitary condition of the towns of Bombay; but, as pointed out by the Army Sanitary Commission, the death statistics of some show that increased activity in this direction is much needed.

Sanitary work in the local fund circles consisted chiefly in the improvement of wells and other water sources.

Punjab.

The only important sanitary work executed in the Punjab in 1881 was the completion of the works for the water-supply of Lahore. The service reservoir had failed, but a constant supply had been kept up to the whole of the city and suburbs, with the exception of certain localities at a high elevation. The water was pronounced to be of excellent quality, and the prejudice which the people had at first entertained regarding it was disappearing, and the demand gradually increasing. The householders, it is stated, were not showing much disposition to have the water connected with their houses, which is attributed to the water-rates being too high; consequently the *bhisties* employed by the richer inhabitants take possession of the stand-posts to the exclusion of the poorer classes. The drainage works of the city were reported to be progressing satisfactorily, and when completed would leave little to be desired in respect of thorough conservancy.

At Delhi plans and estimates for the city waterworks were completed; the old Shahjahani drains were opened up and thoroughly cleaned out; and the Conservancy Department, which was re-organised in 1879, has proved very successful, with the result that the city is now pronounced by all to be very clean and healthy.

At Peshawar a considerable sum was expended on the construction in the city of masonry channels for sewage and for drinking water. These, the Lieutenant-Governor remarks, no doubt constitute a great improvement on the state of things previously existing, but it cannot be allowed that they ensure the water-supply from dangerous pollution. In discussing the disadvantages of the scheme, the Army Sanitary Commission recommend that no similar scheme should be sanctioned for any town in future.

At Amritsar the main drainage scheme was nearly completed round the eastern side of the city, and the internal drainage had been improved by the adjustment of the street drains with the outer main drain. The subject of the drainage of the whole locality with a view of obviating the swamping and water-logging of the soil which resulted from the heavy rainfall of the year has been taken up and surveys have been made. A scheme for improving the water-supply was also under consideration.

In Jullundur and Hoshiarpur important drainage schemes were being carried out; in Ludhiana special measures have been taken to preserve the water-supply both of the district and town from pollution; and in Rawalpindi a scheme for supplying the town with pure water was about to be proceeded with.

Sanitary improvement was engaging the earnest attention of the district authorities, and a fair share of the funds at their disposal was devoted to it. In nearly all the central towns, however, a supply of pure water brought from beyond the inhabited area was much wanted, and in many improved drainage was urgently needed. During the year a considerable number of villages were inspected, when grave sanitary evils were brought to light. These insanitary conditions, the Lieutenant-Governor observes, are closely connected with the habits of the people, and no general reform in these habits can be looked for until the people are convinced of the evils resulting from them. Efforts were, however, being made to diffuse better knowledge on these points among the natives, and Dr. Cunningham's Sanitary Primer has been widely distributed, and has been introduced as a text-book in a large number of schools.

No sanitary work on any great scale was carried out in the North-Western Provinces and Oudh during 1881, still much good work was done in the municipalities in surface drainage, providing sources of pure water, filling in excavations, cleansing wells, &c.

North-
Western
Provinces
and Oudh.

At Almora the drainage of the town site was completed, and the town has now a plentiful supply of good water. The public latrine arrangements were also extended. At Bulandshahr a work of considerable sanitary importance for preventing flooding was carried out, and much progress made in general town improvements. At Cawnpore City a total length of 13,509 running feet of the new drainage system was constructed, and two unwholesome excavations in the middle of the city were completely filled up and levelled, a work which the Sanitary Commissioner considers a very important sanitary improvement. The main city drainage way was extended for the further effectual removal of the rainfall drainage. At Benares the keeping of pigs within the municipal limits was forbidden, but no progress was made with the long-proposed water-supply and drainage scheme, it remaining still under the earnest consideration of the Municipal Committee. At Lucknow a total length of 30,838 feet of stone and masonry-built drains was constructed, new wells were sunk, 17 ditches had been filled up, and many others were in process of filling, and an artesian well sanctioned.

Considerable progress is also said to have been made in rural sanitation, and several districts—notably Jalaun and Babraich—are stated to have followed the example set by Mr. McConaghey in Banda of enforcing a few simple rules to secure cleanliness, and to prevent the pollution of the water-supply. No opposition of any moment to any of the rules appears to have been offered, while the improvement which has been effected in the health of the people by their introduction was very satisfactory.

In the Central Provinces the chief sanitary event of the year was the commencement of a scheme for supplying the city and station of Jubbulpore with pure water from a reservoir seven miles distant, at an estimated cost of 60,000*l*. The work was being actively carried on, and hopes were entertained that early in 1883 the first supply would be turned into the city. Good progress was being made with the Hinganghat water-works, and in several other towns improvements were effected in their sources of water-supply. Out of a total income of 52,214*l*., the municipalities spent 12,338*l*. on conservancy arrangements.

Central
Provinces.

Much good work was done by Civil Surgeons of districts in their inspections of towns and villages; but their reports testify to the fact that many villages suffered from epidemics through their bad sanitary condition. "Vaccination officers," the Sanitary Commissioner reports, "appear to have done fair work in advising the people of the villages on matters of sanitation, and in every district except Seoni have reported some villages as clean, and as attempting sanitary improvements; of course it cannot be expected that great progress can be made in one, two, or even perhaps in ten years, but there is every reason to believe that some good has been already effected, and that the vaccination staff, if properly supervised and kept to their work, will prove a most valuable aid in this direction, and that ultimately substantial progress will be made in village sanitation."

No sanitary works of any great importance were undertaken during the year in the municipalities of Berar, but conservancy and general sanitary arrangements received attention. In the five municipalities of the province the total sanitary expenditure amounted to 2,586*l*. A scheme for the supply of water to the town of Khamgaon was sanctioned, the estimated cost being 8,636*l*. The work, it is stated, was soon to be commenced, and when complete the waterworks are expected to provide an adequate supply of water for all purposes. A project for supplying the town of Amraoti with water was under consideration, but the drainage scheme still remained to be completed.

Berar.

In the districts a large amount of useful work was effected in the course of the year at an expenditure of 8,903*l.*, especially in villages containing more than 5,000 inhabitants, which for registration purposes are classed as towns. The employment of Native Superintendents of Vaccination in sanitary inspection work was attended with satisfactory results, their inspection having proved specially conducive to more careful registration of vital statistics. With the view of extending village sanitation, every village patel has been furnished with a copy of the village sanitary rules, and Dr. Cuninghams' "Sanitary Primer" has been distributed throughout the vaccination service, and also circulated to all schools in the province.

Assam.

Very little progress appears to have been made during 1881 in the way of sanitary improvements in Assam. In fact, as the Army Sanitary Commission remark, sanitary work in this province "is only being begun." The chief improvement effected was the extension of the water-supply to the village of Maokhar and to the regimental lines in the cantonment of Shillong. The drainage system of Gauhati was being slowly carried on, and it is satisfactory to learn that the introduction of properly sunk wells fitted with apparatus for lifting the water was beginning to claim the attention of municipalities. "Even to recognise the necessity of a wholesome water-supply," the Sanitary Commissioner observes, "is a step forward, a mark of progression, and one hails it as a ray of light in a dark and dismal passage." The Government of India have now called the attention of the Chief Commissioner to the want of a pure water-supply in the towns of Assam, expressing a hope "that funds will be speedily made available for this very necessary reform."

During his tour of inspection the Sanitary Commissioner visited many tea-gardens, and he again testifies to the care and attention bestowed on the tea coolies. "The general hutting of the coolies," he says, "and the water-supply in many of the tea-gardens, showed marked signs of improvement, and in many of the better class of gardens I met with indisputable evidence of the kindly treatment bestowed by managers themselves on the tea-garden labourer."

British Burma.

Except in the larger towns, little progress was made in improving sanitation in British Burma. Great progress was made during 1881 in the construction of the works for supplying the town and shipping of Rangoon with water, and for improving the surface drainage of the town upwards of 5,000*l.* have been sanctioned. At Prome sanitary works were energetically carried on; a complete drainage scheme was sanctioned, the works being already in progress; plans were in course of preparation for the erection of a bund to prevent the annual flooding of the town; a scheme for the water-supply of the town was also under consideration, and efforts were being made to abolish the cesspit system. At Bassein 7,000 feet of brick drains were constructed in the course of the year; the reclamation of a great part of the Athegeye swamp was completed; additional public latrines were erected; cesspits were being replaced by proper drains, and a scheme for supplying the town with water was under consideration. At several other towns important improvements were being carried out. In the villages efforts were being made to extend a knowledge of elementary sanitary principles among the people. "A translation of Dr. Cuninghams' Sanitary Primer," the Government state, "altered so as to specially adapt it to Burma, has been prescribed as a school text-book, and copies of the work are being distributed as widely as possible throughout the province; meanwhile district officers should lose no opportunity of encouraging and assisting the people in improving the sanitary condition of villages."

Military.

Bengal.

In the extension of military works in the Bengal Presidency, a sum of 626,243*l.* was expended during the year 1881-82, a large proportion being devoted to sanitary works conducing to the well-being of the soldier. At several stations extensive additions were in progress for the accommodation of both European and Native troops, and many important works for the general improvement of cantonments were in hand. At Allahabad measures were taken for the better supply of water to the cantonment, and the question of providing an improved water-supply both for cantonments and for the fort was under consideration. At Lucknow the drainage of cantonments had been sanctioned at an estimated cost of 1,654*l.*; the earthwork of drains in the Royal Artillery lines was completed, and a large masonry fall near the same lines commenced. When finished, this latter work is expected to prove very beneficial. At Naini Tal progress was made with the drainage, water-supply, and protective works, and two-thirds

of the undertaking, involving an outlay of 4,000*l.*, were executed. At Amballa satisfactory advance was made with the important water-supply project, 8,459*l.* having been expended on it during the year, and progress was made with the distribution works. The British and Native Infantry bazar reservoirs in connexion with this work were executed, and the actual yield of water was about 210,000 gallons a day. Another important work in water-supply was also in progress at Peshawar. The filter-beds and service reservoirs were completed at a cost of 9,862*l.*; a commencement had been made with the distribution, and at the close of the year was accomplished through about half the length of the station. At Cherat good progress was made with the water-supply, and storage room provided for 21,874 gallons, the daily average supply from the springs being about 13,000 gallons. At Quetta the drainage scheme was commenced, some of the channels being newly aligned, widened, and properly sloped.

In the Madras Presidency various improvements were effected in connexion with the barracks of European troops, and at the several stations the usual amount of conservancy and other minor sanitary work was carried out. Among the more important sanitary works in progress or undertaken during the year was a system of drainage at Secunderabad, which was being constructed to carry off the foul water from the Royal Artillery married quarters, an improvement which appears to have been greatly needed. From all stations favourable reports were received as to the quality and quantity of the water-supply, while every care was taken to prevent pollution, and filters were in use. No pains were spared, it is stated, to amuse the men and to make time pass as pleasantly as possible, special recreation and reading-rooms having been provided, out-of-door games and gymnastics encouraged, and soldiers' gardens and other means of recreation fostered. Madras.

The actual outlay on military sanitary works in the Bombay Presidency during 1881 was 42,211*l.*, of which amount 24,310*l.* were expended on the new water-supply of Nasirabad. The drainage of the bazar at Nasirabad was also being further improved at the expense of the Cantonment Fund. At Poona the drainage of the Ghorpuri lines was improved, as was also the ventilation of the barracks by wire-gauze doors to break the inflowing currents on the men at night. At Hyderabad steps were being taken to modify the overflow from the Indus river in the vicinity of the cantonment, and a scheme for improving the drainage of the military buildings was approved. The insanitary condition of the station of Neemuch was still engaging the attention of the authorities, and medical officers were requested to submit reports as to the probable causes of sickness peculiar to the station. At several other stations improvements in surface drainage were carried out, extra accommodation was being provided, and attention given to minor sanitary matters. Healthful exercise was promoted as much as possible; the men are encouraged in various ways to occupy themselves with handicrafts and gardening; and at most of the stations recreation and reading-rooms are provided. Bombay.

INDIA OFFICE, August 1883.

ABSTRACTS
OF
SANITARY AND OTHER REPORTS
FOR
1881.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR 1881.

(*Dr. J. M. Cuningham.*)

European Troops.

During the years 1879 and 1880, the sanitary history of troops in India was complicated by the fact that a large proportion of them was on field service in Afghanistan. Special tables were needed to separate the statistics of the troops in the field from those of the troops in cantonments, so that the results regarding the army as a whole during the year under review might be properly compared with the results of previous years. For 1881, however, such separate tables are not called for, as nearly all the troops on active service had returned to cantonments by October of the preceding year. Nevertheless, a considerable number of European troops were stationed in Southern Afghanistan during 1881, a strength varying from 3,939 during April to 860 during December. Although these cannot be said to have been on field service, still in many respects—such, for example, as barracks and general surroundings—they were differently circumstanced from what they would have been in Indian cantonments. A special table has therefore been prepared giving the sanitary history of this particular section of the European army, and separate columns have been introduced into other tabular statements with the object of keeping these statistics distinct from those of the army generally.

Sickness and
mortality
among
European
troops.

The average strength of the European army in India was 58,728 during the year, or about a thousand lower than it was in 1880. The sanitary history of the year, as judged from the sick and death-rates, was very favourable. The mortality, 16·86 per 1,000, was 8 per 1,000 lower than the death-rate amongst troops in cantonments during 1880, and lower than in any year since 1877, when it was only 12·71. The admissions into hospital also, 1,604 per 1,000, were lower during 1881 than they had been since 1877; and the daily sick-rate, 69, was lower than it had been during the preceding two years. The principal statistics of each of these five years will be found in the subjoined statement.

Year.	Average Strength.	RATIO PER 1,000 OF AVERAGE STRENGTH.				
		Admissions into Hospital.	Daily sick.	Deaths.	Invaliding.	Total loss.
1877	57,260	1,257	56	12·71	42	55
1878	56,475	1,651	67	21·46	45	66
1879*	49,582	1,977	78	24·28	49†	73†
1880*	51,796	1,789	74	24·85	26	51†
1881†	58,728	1,604	69	16·86	38	55

* Excluding troops serving in Afghanistan.

† Including troops in Afghanistan.

The "Vital statistics of the European army of India for the Ten-year period, 1870-79," afford an easy means of comparing the results of the year under report, and those of the preceding ten years either individually or taken as a whole. This work, was commenced by the late Surgeon-Major B yden in continuation of the previous ten-year period, 1860-69, and has been completed by Surgeon-Major Stephen. The admission and daily sick-rates were above those of the preceding ten-year period, but the death-rate was $2\frac{1}{2}$ (nearly) per 1,000 lower. The invaliding during 1881 was also low as compared with recent years, and was 5 per 1,000 lower than the average of this ten-year period.

Statistics of the European Army of India for the ten-year period, 1870-79, and for 1880 and 1881, compared.

Period.	Strength.	PER 1,000 OF STRENGTH.				
		Admissions.	Daily sick.	Deaths.	Invaliding.	Total loss.
1870-78 - - - -	577,416	1,475	60	19·34	43	62
1880* - - - -	51,796	1,789	74	24·85	26†	51†
1881† - - - -	58,728	1,604	79	16·86	38	55

* Excluding troops in Afghanistan.

† Including troops in Afghanistan.

Nearly two-thirds of the European troops in India are stationed in Bengal, so that the health statistics of the army, as a whole, are greatly dependent on the results obtained in this Presidency. As compared with 1880, there was an improvement during 1881 in the average daily sick, the admissions and the death-rates. The proportion of daily sick was 72 against 75, the admission-rate 1,729 against 1,813, and the mortality 17·05 against 27·73. Not only are the mortality statistics of 1881 favourable, as compared with 1880, but also as compared with the two preceding decennial periods. In the decennium 1860-69, the average death-rate was 29·98, or nearly 30 per 1,000. In the next ten-year period, 1870-79, it was 21·00, or 9 per 1,000 lower. During the year under review, therefore, the mortality amongst the troops in the Bengal Presidency was 4 per 1,000 lower than it was during the period 1870-79, and nearly 13 per 1,000 lower than during the period 1860-69.

Statistics of the Army of Bengal for the ten-year periods, 1860-69, 1870-79, and for 1880 and 1881, compared.

PERIOD.	AVERAGE ANNUAL RATIO PER 1,000.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860-69 - - - -	1,755	67	29·98	41	71
1870-79 - - - -	1,522	61	21·00	41	62
1880* - - - -	1,813	75	27·73	22†	50†
1881* - - - -	1,729	72	17·05	37†	54†

* Excluding troops in Afghanistan.

† Including troops in Afghanistan.

In this report for 1880, it was remarked that the statistics of the European troops serving in the Madras Presidency were exceptionally favourable. On the whole, they were equally favourable during 1881; for, though the mortality rose from the very low ratio of 10·18 in 1880 to 10·97, the admission-rate fell from 1,368 to 1,160, and the daily sick-rate from 64 to 60. The invaliding, 28 per 1,000 (excluding troops in Afghanistan), was higher by eight during 1881 than it was in the previous year; but it was nevertheless considerably lower than in other years, and, as will be seen from the figures given in the following paragraph, very much lower than the average of the decennium 1870-79, which was 49 per 1,000 of the strength.

The death-rate amongst European troops of the Madras Army was lower during 1880 and 1881 than it has been in any year since the statistics of the Presidency have been compiled in this Office; in both years the ratio was more than six per 1,000 below the average of the ten preceding years. The admission-rate for 1881 was also somewhat lower than the averages of this ten-year period; and, as compared with the average of the ten years 1860-69, the results under all headings were still more favourable, as will be seen from the accompanying statement:—

Statistics of the Army of Madras for the ten-year periods 1860-69 and 1870-79, and for 1880 and 1881, compared.

PERIOD.	AVERAGE ANNUAL RATIO PER 1,000.				
	Admissions into Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860-69* - - - -	1,399	61	19·99	49	69
1870-79 - - - -	1,264	60	17·69	49	67
1880 - - - -	1,368	64	10·18	20	30
1881 - - - -	1,160	60	10·97	28	39

* The figures from which these Ratios were calculated are given in this Office Annual Report for 1877, page 42.

In summarising the statistics of the European troops in Bombay during 1880, it was observed that the death-rate of the year, 30·90 per 1,000, was almost double what it had been in 1879, and that, too, although in 1880 not a single case of cholera had occurred amongst the troops in cantonments. The results for 1881 are even more favourable than those for 1879, the mortality having been only 13·44. The admission-rate for 1881 was 1,784, against 2,150 in 1880, and the daily sick-rate 72 against 78. The invaliding, however, was somewhat higher during 1881—53 against 49 per 1,000.

Statistics are not available to show the averages in the Bombay Presidency for the ten years 1860–69; but in this Office Annual Report for 1875, figures are given for these ten years, divided into two periods of five years each. For comparison with the results of the last two years these are reproduced in the annexed statement, which also shows the ratios for the ten years 1870–79.

Statistics of the Army of Bombay for 1860–64, 1865–69, and 1870–79, compared with 1880 and 1881.

PERIOD.	AVERAGE RATIO PER 1,000.				
	Admissions into Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860–64 - - - -	1,724	?	22·61	30	53
1865–69 - - - -	1,406	56	20·48	36	56
1870–79 - - - -	1,533	57	15·27	43	58
1880 - - - -	2,150	78	30·90	49	80
1881 - - - -	1,784	72	13·44	53†	67†

* Excluding troops in Afghanistan.

† Including troops in Afghanistan.

It will be seen from the above that the admission, daily sick, and death-rates of the year under report compare very favourably with those of 1880. As regards the mortality, it also compares favourably with the ten and the two five-year periods into which the statistics of the preceding twenty years are classified. The sickness, however, was higher during the last two years, and the invaliding during 1881 was above the averages of the five and ten year periods.

As already mentioned a portion of the European army of India during 1881 was in Southern Afghanistan. These troops were taken partly from Bengal and partly from Bombay. The average strength of the whole was 2,541. Though the admission-rate was low, 968 per 1,000, the daily sick and death-rates equalled 72 and 51·55 respectively. These troops suffered severely from enteric fever, dysentery, and respiratory diseases.

The relative prevalence of the several forms of sickness was in accord with the experience of previous years. Malarial fever stood first in each of the three Presidencies, but whereas in Bengal and Bombay about half the total admission-rate was due to this cause, in Madras it gave rise to little more than one-fourth. This will be seen from a glance at the following statement, where the principal causes of admission into hospital are arranged in the order of frequency, together with the ratios per 1,000 of strength from each cause. With one trifling exception, the admissions bore the same relative frequency in each of the three Presidencies :—

Admissions from Chief Diseases per 1,000 of strength.

Bengal.			Madras.			Bombay.		
1. Malarial fevers -	-	764	1. Malarial fevers -	-	279	1. Malarial fevers -	-	841
2. Venereal diseases -	-	276	2. Venereal diseases -	-	258	2. Venereal diseases -	-	261
3. Wounds and accidents -	-	106	3. Wounds and accidents	-	104	3. Wounds and accidents	-	106
4. Respiratory diseases -	-	87	4. Abscess and ulcer -	-	78	4. Respiratory diseases	-	93
5. Abscess and ulcer -	-	86	5. Respiratory diseases	-	40	5. Abscess and ulcer -	-	86
6. Diarrhoea -	-	56	6. Diarrhoea -	-	44	6. Diarrhoea -	-	57
7. Rheumatism -	-	50	7. Rheumatism -	-	43	7. Rheumatism -	-	40
8. Hepatitis -	-	32	8. Hepatitis -	-	39	8. Hepatitis -	-	29
9. Dysentery -	-	29	9. Dysentery -	-	37	9. Dysentery -	-	23
TOTAL OF THE NINE -	-	1,486		-	981		-	1,536
TOTAL FROM ALL CAUSES -	-	1,729		-	1,160		-	1,784

With regard to the diseases which gave rise to the greatest mortality, cholera stood highest in Bengal and in Madras; the ratios having been 3·23 and 1·73 per 1,000 for these Presidencies respectively, and next to it enteric fever in Bengal and Bombay. In the latter Presidency cholera occupied the lowest position amongst the chief causes of death. The subjoined statement gives, in a concise form, the chief causes of mortality, and also the death-rate from all causes in the three Presidencies for a series of years :—

Deaths from	BENGAL.				MADRAS.			BOMBAY.		
	1881.*	1880.*	1870-79.	1860-69.	1881.	1880.	1870-79.	1881.*	1880.	1870-79.
Cholera - - -	3·23	4·84	4·18	9·24	1·73	0·10	1·68	0·30	—	1·38-
Enteric Fever - - -	2·62	3·07	2·28	?	0·58	1·36	1·42	2·83	5·76	1·75
Apoplexy - - -	1·75	8·14	1·53	2·19	0·96	0·78	1·42	1·21	3·08	1·56
Hepatitis - - -	1·64	1·36	2·04	3·31	1·54	1·26	3·16	1·52	1·31	1·71
Dysentery - - -	1·00	2·72	1·37	2·72	1·15	0·58	2·32	1·82	4·14	0·98
Diarrhoea - - -	0·31	1·17	0·12	0·75	0·19	0·19	0·04	0·30	2·02	0·17
Remittent and Continued Fevers	0·70	2·34	1·74†	2·92	0·19	0·29	0·62†	0·91	2·73	1·14†
TOTAL OF THESE DISEASES -	11·25	18·64	13·26	21·13	6·34	4·56	10·66	8·88	18·99	8·84
ALL CAUSES -	17·05	27·73	21·00	29·98	10·97	10·18	17·69	13·44	30·90	15·27

* Excluding troops in Afghanistan and on the march.

† Include deaths from intermittent fever.

This statement further serves to show that in 1881 there was a general diminution in the mortality from enteric fever, as compared with the statistics of the year previous. In Bengal the death-rate from this cause fell from 3·07 to 2·62, in Madras from 1·36 to 0·58, and in Bombay from 5·76 to 2·83. During the ten-year period, 1860-69, the cases of enteric fever returned were so few that they were not classified separately, but included under remittent and continued fevers. The mortality amongst the troops in Madras is, under almost all the principal headings, lower than amongst those of the other two Presidencies.

Sickness and mortality in groups of stations.

The following statement shows the admission and death-rates in the several groups of stations of the Bengal Presidency during the ten-year periods, 1860-69, 1870-79, and during 1880 and 1881 :—

PERIOD.	RATIO PER 1,000 OF STRENGTH.													
	BENGAL PROPER.		GANGETIC PROVINCES AND OUDH.		MEERUT AND ROHILCUND.		AGRA AND CENTRAL INDIA.		PUNJAB.		HILL STATIONS.		BENGAL PRESIDENCY.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1860-69-	1,821	29·57	1,615	28·59	1,576	26·61	2,169	38·43	1,741	25·24	1,069	14·78	1,755	29·98
1870-79-	1,311	14·43	1,410	20·06	1,461	18·31	1,530	18·41	1,847	20·71	1,044	12·28	1,522	21·00
1880* -	1,469	16·03	1,494	29·32	2,011	22·98	1,935	15·07	2,126	36·41	1,253	20·15	1,813	27·73
1881* -	1,610	12·02	1,741	15·94	1,867	17·81	1,728	10·11	1,949	23·44	1,177	9·97	1,729	17·05

* Excluding troops in Afghanistan.

The admission-rate varied in these groups of stations from 1,177 per 1,000 in the hills to 1,949 in the Punjab. From the above tabular statement it will be seen that the mortality, 23·44, was higher in the Punjab than in the other groups. This was also the case in 1880, when it was as high as 36·41. It was 45·01 in 1879. As compared with 1880, there is a diminution in the death-rate in all the groups, the decrease in the Gangetic provinces and Oudh group being very marked, from 29·32 per 1,000 to 15·94; but 14·50 of the total death-rate during 1880 was due to cholera. In 1881 the death-rate from cholera in this group was 2·97. As compared with the results of 1870-79, there was during 1881 a decrease in the mortality of each of the groups, with the exception of the Punjab, where the death-rate of these ten years averaged nearly 3 per 1,000 less than the death-rate of 1881. As compared with the ten-year period 1860-69, the decrease in the mortality of 1881 is still more marked. As averages alone may mislead, it should be added that between 1860 and 1869 the annual death-rate in the Bengal Presidency never fell below 20·11, and that in most of the years between 1870 and 1879, it largely exceeded the ratio for 1881. All these data show that a very considerable reduction has been effected in the mortality of European soldiers in the Bengal Presidency during the last 22 years.

The disease which gave rise to the highest death-rate in any of the groups was cholera, which caused a loss of 7·00 per 1,000 of strength in the Punjab; and the next highest death-rate was 4·00 per 1,000 from enteric fever, in the Agra and Central India group,—the group which furnished the lowest death-rate from cholera in the

Presidency, excepting the Hill stations, where the ratio was slightly lower. The death-rate from hepatitis, 2·30 per 1,000, was higher in the Gangetic provinces than in any other group.

There are 50 stations included in the several groups above referred to, 41 of which had an average strength of over 200 during 1881. Of these 41, two, Delhi and Amritsar, presented an admission-rate of over 3,000 per 1,000. Peshawar had an almost equally high admission-rate, namely, 2,966. In each of these three stations, fevers gave rise to over 2,000 of the total. Out of the 38 remaining stations, with a strength of 200 and over, four, Meerut, Jhansi, Fatehgarh, and Meean Meer, presented an admission-rate of over 2,000. About two-thirds of the total in them were due to fevers, with the exception of Meerut, where fevers contributed only 788, the total in this station being made up of high ratios under several other headings, diseases of respiratory organs, venereal diseases, and "all other causes."

As regards the mortality in the larger garrisons, four returned a death-rate of less than five per 1,000—Saugor, 2·69, Jhansi, 2·80, Fort William, 4·32, and Chakrata, 4·74. With the exception of Jhansi, the admission-rate in these four stations was also comparatively low; that for Fort William having been 1,566. For several years past, Fort William has been amongst the healthiest stations in the Bengal Presidency; during the last four years the death-rate here has ranged from 9·56 in 1878 to 4·32 in the year under review. From other stations the returns are much less favourable. Four of them show a death-rate of 40 per 1,000 and over—Jullunder 40·60, Amritsar and Govindgarh 46·61, Meean Meer 84·08, and the adjoining fortress of Lahore 137·93. The deplorable mortality at Meean Meer and Lahore was mainly due to cholera, 57·37 of the total death-rate having been due to this cause at Meean Meer, and 112·07 at Lahore. The mortality from other causes in these garrisons was therefore 27·71 and 25·86, respectively. At Jullundur, 6·02 of the total ratio was due to cholera, and 16·95 at Amritsar. Of the deaths from cholera which took place during 1881 in the Bengal Presidency, 80 occurred in the garrisons of the Punjab, and all, save one, occurred in the four stations above named.

During the ten-year period 1870—79, of the larger stations in the Bengal Presidency, eight have furnished an average annual death-rate of less than 12 per 1,000. Three of these are in the plains and five in the hills. The plains stations were Jhansi, with a ratio of 10·64, Fort William, with a ratio of 10·78, and Fategarh, with 11·51. In order to judge of the comparative healthiness of these stations, however, it is necessary to note also their average admission-rates during the same period; these were, at Jhansi 2,227 per 1,000, Fategarh 1,288, and at Fort William 1,106—so that, taken altogether, the returns, as regards sickness and mortality from the last-named garrison, have been the most favourable in the Presidency from 1870 to 1879. During the ten preceding years 1860—69, the average annual mortality at Fort William, 25·19, was more than double what it was during the period 1870—79. It is instructive to note the difference, during recent years, in the salubrity of this station, as compared with its near neighbours Dum-Dum and Barrackpore, which complete the Bengal Proper group. As already observed, all three are on the banks of the Hooghly, and the furthest removed is within 14 miles of Calcutta. The leading features in the sanitary history of these places during the ten-year periods 1860—69 and 1870—79, as also of the years 1880 and 1881 may be gathered from the following statement:—

PERIOD.	FORT WILLIAM.			DUM-DUM.			BARRACKPORE.		
	Admissions.	Deaths.		Admissions.	Deaths.		Admissions.	Deaths.	
		Cholera.	All causes.		Cholera.	All causes.		Cholera.	All causes.
1860-69	1,720	8·85	25·19	1,948	4·26	32·70	1,892	8·83	32·12
1870-79	1,106	1·26	10·78	1,138	0·50	15·33	2,011	0·49	20·96
1880	1,349	—	11·55	1,419	—	21·63	1,979	—	16·53
1881	1,566	1·08	4·32	1,582	4·29	17·17	1,829	—	24·39

During 1860 Fort William suffered very severely from cholera, 33·39 per 1,000, out of a total death-rate of 51·75, having been due to this disease. In 1862 there was another severe outbreak, causing a death-rate of 14·77 per 1,000, but since then the cholera mortality in any one year has never risen above 8·52 per 1,000. The reduction from 8·85 in the first ten-year period to 1·26 in the second is remarkable. In the other two stations, although cholera has also largely diminished, other diseases have not been reduced in a corresponding degree.

During the ten-year period 1860-69, there were 18 principal military stations, with a strength of more than 200 men, which returned an average annual death-rate of over 25 per 1,000. During the next ten-year period 1870-79, there were only two in this category—Peshawar, where the ratio was 28·55, and Meean Meer, where it was 34·87. Two other of the larger stations registered an annual mortality of nearly 25 per 1,000 during the same period, Morar and Fyzabad.

More than one-fourth, or 9,095, of the average strength of European troops in Bengal were located in the hills during 1881. Owing to the large proportion of troops on active service during the two preceding years, the number which could be placed on the hills was small as compared with ordinary years. Whereas in 1878, for example, 25·6 per cent. of the troops were on the hills, in 1879 the proportion was 13·7, and in 1880, 17·5. The percentage during 1881 was nearly equal to that of 1878, having been 25·3. There were further, 749 women and 1,511 children in the hills during the year under review. The admission-rate in the hill stations during the year equalled 1,177 per 1,000 against 1,253 in 1880; and the death-rate 9·97, against 20·75 for the same years. In 1880, 5·88 per 1,000 of the total mortality was due to enteric fever, against 2·49 in 1881. As regards the convalescent depôts the admission-rate was 1,394, against 1330 in 1880; and the death-rate 10·35 against 14·84. The chief causes of the decreased ratio during 1881 were a falling off in the deaths from phthisis, from 3·15 to 1·42 per 1,000, and a smaller proportion of deaths out of hospital.

As compared with the years 1879 and 1880, the returns of European troops of the Bombay Presidency serving in Rajputana, Malwa, Sind, and Aden in 1881 are very favourable. The admission-rate fell to 1,995 from 2,332 in 1880, and the death-rate from 23·04 to 11·90. Seven per 1,000 of the high death-rate of 1880 was due to enteric fever: in 1881 the mortality from this disease was 3·23.

The Deccan and Nagpur group of stations include the garrisons of Bombay, Poona and Kirkee, Belgaum, Secunderabad, Kamptec, and some smaller places. The strength of the group during 1881 was 7,426. The admission-rate was 1,390, against 1,708 during 1880; and the death-rate, 12·52, was almost identical with the ratio for 1880.

The Southern India group of stations consists of Bellary, Bangalore, Cannanore, Madras, and three other garrisons. The sanitary history of the group during 1881 corresponds very closely with that of the previous year—the admission-rate 1,236 against 1,411 in 1880; and the death-rate 7·74 against 7·23. With the exception of the hill stations of Madras and Bombay, the Southern India group furnished the most favourable mortality returns in the three Presidencies.

In last year's report it was mentioned that the troops serving in Burma and Pegu enjoyed better health than those of any of the other groups into which the army of India is divided. As already mentioned, the mortality in the Southern India group was, during 1881, the lowest; but, as regards admissions into hospital, the ratio for the Burma and Pegu group, 1,122 per 1,000, was the most favourable. The death-rate was 10·9 against 6·22 in 1880.

Amongst the troops occupying the hill stations and convalescent depôts of the Madras and Bombay Presidencies, of an average strength of 762, which was almost the same number as that of the preceding year, the admission-rate was 1,168 against 1,270 during 1880; the daily sick-rate 60 against 63, and the mortality 6·56 against 17·11. There was, thus, an improvement under every heading. There was only one death from enteric-fever registered in this group.

The highest death-rate returned by any station in the Madras Presidency during 1881 was at Kamptec, 26·58 per 1,000; but more than one-half of this ratio was due to cholera, and 4·43 of the total deaths took place out of hospital. In 1880 the total mortality at this station equalled 20·73; but none of this was due to cholera or to deaths out of hospital. At Cannanore and Bangalore the death-rate during 1881 was but little over 5 per 1,000; and at Tounghoo, in British Burma, only 4·44. The statistics of the other stations for the year under review do not call for any special remarks. Of the larger cantonments, St. Thomas' Mount returned the highest death-rate during the ten-year period 1870-79, 21·70 per 1,000, with an average admission-rate of 1,264 and a daily sick-rate of 64. In 1880, although there was a marked diminution in the mortality, the ratio being only 14·33, the daily sick and admission-rates were high, 86 and 1,642. But in 1881 there was a falling off under each of the above heads; not only as compared with the figures of the year previous, but also as compared with the statistics of the ten-year period. During the above-cited decennium, the lowest death-rate, 9·52, was recorded at Bellary. At Wellington, during 1870-79 the death-rate

averaged 15·94 per 1,000; in 1800 the ratio stood at 12·92, and in 1881 it fell to 6·97.

The average death-rate amongst European troops in the cantonments of the Bombay Presidency during 1881 was 13·44 per 1,000. The statistics of individual stations show that, omitting small stations, this ratio was exceeded during the year by the death-rates for Nasirabad, Baroda, Karachi and Ghizree, and Ahmednagar. During 1880 the ratios at these places, with the exception of the last-named, were high. At Nasirabad, Karachi and Ghizree, the mortality ratios were likewise high during the ten-year period 1870—79, 21·69 and 16·11, nearly one-third in each instance having been contributed by enteric and other fevers. Taken altogether, the most favourable returns furnished by any station in the Bombay command were received from Aden; the admissions were 805, the daily sick 32, and the death-rate only 3·96 per 1,000. In 1880 the mortality at this station equalled 20·35, the high ratio having been, in great part, due to a considerable number of deaths from enteric fever. During the decennium ending 1879, the ratio stood at 14·15 per 1,000.

Of the 990 deaths which occurred amongst the European troops of the army of India, Cholera. 137 were due to cholera, which is equal to a ratio of 2·33 per 1,000 of the strength. Thus, a little over one-seventh of the mortality from all causes was due to this disease. In 1880 the death-rate from cholera was a little higher than this, 2·8 per 1,000, and in 1879 the ratio went as high as 11·07; but considerably more than half of this mortality was due to deaths which occurred amongst the troops in Afghanistan. As regards the year under report, 116 of the total 137 deaths occurred in Bengal, 18 in Madras, and three in Bombay. No case occurred amongst the troops serving in Southern Afghanistan. Exactly one-half of all the deaths which occurred in the Bengal Presidency took place during June, July, and August, at Meean Meer. At the adjoining fortress of Lahore, 13 deaths occurred about the same period; and at Lucknow 17 deaths occurred, but, for the most part, later in the season. Compared with the ten-year period 1870—79, the cholera mortality for 1881 for the army of India was nearly 1 per 1,000 lower than the annual average, and the ratio for the army of Bengal was lower to somewhat the same extent; but as compared with the annual ratio yielded by the ten-year period 1860—69, the cholera mortality of 1881 in Bengal was very nearly one-third lower.

Considering how widely prevalent small-pox is in most parts of India, it is remarkable how seldom European troops suffer from the disease. During 1881 there were only 17 cases, with one death, amongst the troops dispersed over the whole of India. And this is no unusual experience. Small-pox.

The low ratio of mortality from small-pox is manifest in each of the Presidencies. In Bengal the ratio for the ten-year period 1870—79, namely 0·12, is only about one-third of the annual ratio of the preceding ten years, 1860—69. Nor is the disease, as might have been expected, characterised by being specially limited to certain stations in different years. For example, the 60 deaths which occurred in the three Presidencies between 1870 and 1879 were distributed amongst 28 stations; and the 132 deaths which were registered in Bengal only, during the preceding ten-year period, occurred in 30 stations.

As usual, intermittent fever proved by far the most frequent cause of admissions into hospital; not only because of the prevalence of the disease in nearly every part of the country, but also because of its repeated recurrence in the same individual. In Bengal, the admission-rate, 663, was more than a third of the ratio from all causes; in Madras it was 238, or a little over a fifth of the total admissions. In Bombay the ratio was 754—not far from half the total admission-rate. Great fluctuation has occurred in the prevalence of this disease. In Bengal the admission-rate from intermittent fever was higher during the last two years than the annual average ratio of the two decennial periods, 1860—69 and 1870—79. In Madras and Bombay, there is a similar result as regards the two last years when compared with the ten-year period 1870—79. The mortality from intermittent fever is no guide to its prevalence. In the Bombay Presidency, for example, not a single death was ascribed to this cause during 1881; whereas, according to the admission-rate, it was more prevalent amongst the European troops of Bombay than among those of either of the other two Presidencies. Fevers.

Fevers of a remittent and continued type, however, were not so prevalent as during the preceding year, nor were they as prevalent as during the immediately preceding ten-year period. Madras returned the lowest admission and death ratios from these

fevers, and the rates are lower than they were during 1880, or during the preceding decennium. In Bengal, also, there was a marked diminution during 1881, both in the admission rate and still more in the death-rate, as compared with the year previous and likewise as compared with the average ratios of the two preceding ten-year periods.

It is not quite clear to what extent the diminished ratios from "continued fever" may not be due to greater separation of enteric fever from other types of fevers of a continued and more or less remittent character. Previous to 1871 no attempt was made to separate the statistics of enteric fever amongst troops in this country from those of other fevers, and even since that year the returns have at times presented such discrepancies as to suggest that what was designated enteric fever in one Presidency was included amongst the returns of continued and remittent in others. For several years past a comparative statement of these returns has been given in this report in the subjoined form, from which it will be seen that if the figures for the eleven years, 1871 to 1881, be carefully followed, a very intimate relation exists between the death-rate from the two groups of fevers:—

Statement showing the death-rate from Fevers per 1,000 of strength among the European Troops of the Three Presidencies from 1871 to 1881.

PRESIDENCY.	FEVERS.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Bengal	Intermittent, remittent, and continued.	2·25	1·78	1·39	1·10	1·18	0·71	0·66	1·59	3·90	3·44	0·81
	Enteric - - -	1·71	1·62	1·53	2·01	1·59	1·75	1·55	4·69	4·59	3·69	2·62
	Total - - -	3·96	3·40	2·92	3·11	2·77	2·46	2·21	6·28	8·49	7·13	3·43
Madras	Intermittent, remittent, and continued.	0·83	0·69	0·70	0·17	0·36	0·46	0·27	1·11	0·76	0·39	0·19
	Enteric - - -	1·47	2·34	0·78	1·04	0·63	1·99	2·00	1·20	1·44	1·36	0·58
	Total - - -	2·30	3·03	1·48	1·21	0·99	2·45	2·27	2·31	2·20	1·75	0·77
Bombay	Intermittent, remittent, and continued.	1·01	0·74	0·56	0·76	1·28	0·29	0·50	1·12	1·61	3·23	0·91
	Enteric - - -	1·48	2·22	1·31	1·33	1·77	1·86	1·39	2·55	1·93	5·76	2·83
	Total - - -	2·49	2·96	1·87	2·09	3·05	2·15	1·89	3·67	3·54	8·99	3·74

If the ratios be thrown into the form of a diagram, it will be observed that as regards Bengal, for example, the intermittent, remittent, and continued fever-curve runs a closely similar course with that of enteric fever throughout the entire period. From 1871 to 1877 the mortality ratios of both groups are low. In 1878 and 1879 the enteric fever-curve goes very high; that representing the course of the other group of fevers also rises considerably in 1878, and still more so in 1879, until the ratios in both groups become nearly identical. The mortality from both classes of fever continued to be very high during 1880, and in 1881 a diminution occurs in both classes. The Bombay returns show an equally striking correspondence as to the mortality ratios from both classes of fever. From 1877 to 1880 the figures become more and more unfavourable, and in 1881, just as was the case in Bengal, the ratios of both groups show improvement. In Madras the correspondence is not so striking, but, as has been more than once observed in this Office Annual Report, the returns from this Presidency for some of the years of the period for which comparative data are available appear to have been influenced by the opinion held by the then Surgeon-General, Her Majesty's Forces, in that Presidency, that enteric fever does not occur amongst European soldiers in India.

Enteric fever.

During the ten-year period 1870–79, the admission and death-rates from enteric fever were higher in Bengal than in either of the other Presidencies, the mortality having been 2·28 per 1,000 against 1·75 in Bombay and 1·42 in Madras. During the last two years, however, Bombay has occupied the highest place in this respect, 5·76 in 1880 and 2·83 in 1881, against 3·07 and 2·62 for the same annual periods in Bengal. Both as regards admissions and deaths the ratio in Bombay during 1881 was less by over one-half what it was in 1880. In Madras the returns for the year under review are still more favourable, as may be learnt from the following statement:—

PERIOD.	BENGAL.						MADRAS.						BOMBAY.					
	Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.			Admissions per 1,000.			Deaths per 1,000.		
	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.	Enteric Fever.	Other Fevers.	Total.
1870-79 -	5.3	807.8	612.6	2.28	1.74	4.02	3.9	208.5	270.4	1.42	0.62	2.04	3.1	659.9	683.0	1.75	1.14	2.89
1880 -	8.7	809.6	818.3	3.07	2.66	5.73	2.6	450.1	452.7	1.36	0.39	1.75	8.5	1,117.3	1,126.8	5.76	5.23	8.99
1881 -	6.5	763.9	770.2	2.62	0.81	3.43	0.9	278.7	279.6	0.58	0.19	0.77	4.2	840.6	814.8	2.83	0.91	3.74

* Excluding troops in Afghanistan.

Cases of enteric fever were returned in most of the stations of the Bombay Presidency, though in many of them there was only a single case. The disease was consequently very widely distributed, though the number of cases throughout the Presidency was by no means large as compared with the strength of the army. Of the 227 admissions from the disease, however, 109, or nearly one-half, occurred in six stations,—at Lucknow 46, Rawalpindi 15, Bareilly 14, Meean Meer 12, Dum-Dum 12, and at Ranikhet 10. Amongst these 109 admissions, 33 deaths occurred, a little over one-third of the total deaths. Meerut contributed largely to the mortality from the disease, seven deaths out of nine cases.

As regards the relation which exists between enteric fever in this country and age and length of residence, the following abstracts furnish a summary of the more important figures. The first gives the composition of the army according to age for the last 11 years, from which it will be seen that during 1881, 43 per cent. of the strength of the army in India was under 25 years of age, a larger proportion of very young men by 10 per cent. than was the case five years previously. On the other hand, the proportion of men of 30 and over has gradually diminished, and now stands at 22 per cent. of the strength.

YEAR.	Under 25.	25 to 29.	30 and upwards.	
1871-75 -	38 per cent.	27 per cent.	35 per cent.	
1876 -	33 "	33 "	34 "	100
1877 -	33 "	35 "	32 "	100
1878 -	35 "	36 "	29 "	100
1879 -	39 "	33 "	28 "	100
1880 -	41 "	34 "	25 "	100
1881 -	43 "	35 "	22 "	100

In 1880 there were in the army of India 143 deaths from enteric fever amongst men under 25 years of age, which was equivalent to a proportion of 6.25 per 1,000 of the strength at that age; whereas amongst men above 25 there were only 74 deaths, or equivalent to 2.22 per 1,000, so that men under 25 were about three times more susceptible to the disease than the remainder of the army. In 1881 the great susceptibility of young men to enteric fever is again clearly shown; for, whereas the death-rate among men under 25 years of age was 4.56, that among those between 25 and 29 years of age was only 1.57. Some of these statistics are given in the subjoined abstract.

Statement showing the death-ratios of the European Army from Enteric Fever at different Ages and different Periods of Residence in India, together with Ratios of Liability to it for 1877-81.

YEAR.	MORTALITY FROM ENTERIC FEVER, AND RATIO OF LIABILITY TO IT AT DIFFERENT AGES.						MORTALITY FROM ENTERIC FEVER, AND RATIO OF LIABILITY TO IT AT DIFFERENT PERIODS OF RESIDENCE IN INDIA.					
	Under 25.		25 to 29.		30 to 34.		1st and 2nd Years.		3rd to 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.	Deaths per 1,000.	Percentage of Liability.
1877 -	2.45	44.2	1.55	27.9	0.99	17.8	3.31	59.5	1.35	24.2	0.90	16.1
1878 -	6.04	53.0	3.55	31.1	1.04	9.1	7.90	63.4	2.64	21.2	1.38	11.0
1879 -	6.17	54.1	2.73	28.9	1.78	15.6	7.99	67.2	2.18	18.8	1.24	10.4
1880 -	6.25	56.26	3.15	28.35	1.09	9.81	9.08	75.98	1.78	14.90	0.47	8.93
1881 -	4.56	59.84	1.57	20.60	0.79	10.37	4.55	60.02	2.07	27.31	0.56	7.39

For some years past attention has been drawn in this Office Annual Reports to the apparent connexion existing in this country between enteric fever, youth, and non-acclimatisation. In the section of the report of the Army Medical Department for 1875, dealing with the results in the Bombay Presidency for that year, the question of the effect of acclimatisation as regards enteric fever referred to is as follows :—

The relation between the prevalence of enteric fever and locality is obscured by the evidence of its relation to periods of residence in the command, or, in other words, the immensely greater susceptibility of new comers to contract this disease, than that existing in the case of those whose susceptibility may have been weakened by the influence of a longer exposure to its exciting cause. In the present year, two corps, having together a strength of 1,839 non-commissioned officers and men, arrived in the Bombay command from England; the admissions from enteric fever amongst them were 25, being in the rate of 13·6 per 1,000 men. In the other corps in the command, having a strength of 8,503 non-commissioned officers and men, there were 17 admissions for enteric fever, being in the rate of two per 1,000; but in these corps were 401 men newly arrived from home, and it was in this small number that most of the 17 attacks of enteric fever occurred.

As a natural consequence of the annually increasing proportion of young men in the army of India, it follows that the proportion of acclimatised soldiers is much diminished. The year under review brings out this fact more strikingly than any of the preceding ten years, as may be seen from the following statement, in which the proportion of men who have served in the country for two, five, and seven years is entered :—

Statement showing the Proportion of Men who have served in India Two, Five, and Seven Years, from 1871—81.

PERIOD.	PERCENTAGE OF MEN TO TOTAL STRENGTH WHO HAVE SERVED IN INDIA.			PERIOD.	PERCENTAGE OF MEN TO TOTAL STRENGTH WHO HAVE SERVED IN INDIA.		
	Two Years and under.	Five Years and under.	Seven Years and under.		Two Years and under.	Five Years and under.	Seven Years and under.
1871 - -	36·2	64·6	78·9	1876 - -	25·5	57·6	75·1
1872 - -	33·7	66·7	80·0	1877 - -	25·2	56·2	72·6
1873 - -	31·7	65·5	79·6	1878 - -	28·9	59·8	73·0
1874 - -	25·9	64·3	79·8	1879 - -	32·1	60·9	72·6
1875 - -	26·1	60·1	81·0	1880 - -	33·4	65·4	77·2
				1881 - -	38·9	70·4	81·1

The distribution of the enteric fever deaths according to residence was as follows :—

Two years and under	-	-	-	4·55 per 1,000
3rd to 6th year	-	-	-	2·07 „ „
7th to 10th year	-	-	-	0·56 „ „
10th year and upwards	-	-	-	0·40 „ „

It will be observed that 38·9 per cent., or considerably more than one-third, of the army had not served in India above two years, which is $5\frac{1}{2}$ per cent. higher than the proportion in 1880, and some 13 per cent. higher than the proportion five years previously. From what has been said in this and the preceding paragraph, it follows that, both as regards age and acclimatisation, the troops in 1881 were in a more favourable position than in 1880, or in any other year of which we possess satisfactory records. Notwithstanding this, the death-rate from enteric fever fell from 3·63 to 2·64 per 1,000, but the death-rate from all causes fell in an even greater proportion—from 28·32 in 1880 to 16·86 in 1881. It would, therefore, appear that the prevalence of enteric fever even among young men new to India is greatly dependent on the general character of the year—whether it is healthy or unhealthy. It has long been observed that the season of its most marked prevalence in this country is that which is associated with the greatest heat; and the late Dr. Bryden was strongly of opinion that this relation is more than a coincidence. The connexion is more apparent in Upper India than it is in either Madras or Bombay, that is to say, in the part of the peninsula where a more strongly marked difference exists between the hot and the cold season. In those part of the country where the temperature, though high, is tolerably equable throughout the year, enteric fever, as judged by monthly returns, is more evenly distributed.

For some years past special inquiries have been instituted in the three Presidencies, with the object of tracing the origin of the disease to a distinct cause, and reports have been received regarding every fatal case of enteric fever which has occurred among the troops. Owing, however, to the barrenness of the results, it was decided last year that in Bengal these special reports should be discontinued, recourse being had to the ordinary

annual and casualty reports for any information that can be had. In the meantime the special reports from the Madras and Bombay Presidencies are to be continued.

That in several stations of the Bengal Presidency earnest endeavours have been made to trace the origin of enteric fever to some cause, is abundantly evident from the annual reports of the medical transactions of the various regiments which have been placed at the disposal of this office by the Surgeon-General, Her Majesty's Forces. At Ranikhet, for example, Surgeon-Major Gore has furnished a full account of the enteric fever cases which occurred at that station amongst the men of the 30th Regiment. In last year's annual report, an account was given of the history of this regiment from notes which had been prepared by Dr. Lewis, as a result of personal inquiry. The regiment had landed in Bombay in February, 1880, and detachments had been distributed to Shahjahanpur and Moradabad, whilst the head-quarters proceeded to Ranikhet. Cases of enteric fever occurred in each sub-division of the regiment. In 1881 there were eight cases more, and three deaths, amongst the men at Ranikhet—all but one man having been less than two years in India. The last case in 1880 occurred in November, and the first case amongst the men in 1881 was admitted on the 30th May. Regarding the probable causation of the disease at this station, Dr. Gore writes: "Nothing very definite could be traced. The cases came from barracks widely separated. In two, some local insanitary conditions appeared to have been pre-existing, but in one of these the patient felt ill immediately after a shooting excursion, and the other after a cricket match. One man appeared to have contracted the disease in hospital, the remainder were admitted from blocks whose filters and latrines were in good order, and where there was nothing objectionable in the immediate surroundings at all events. Of this fact I satisfied myself by a personal inspection. One of the men drank no milk at all, and the others only a little in their tea. The water-supply at its source is certainly good, and no traces of organic or sewage contamination were detected on rough analysis. A mere trace of chlorides occurred only in the water. Allowing that a latrine was faulty, it is difficult to conceive how only one, out of several who frequented it, was affected with fever. The probabilities are altogether adverse to the supposition indirectly supported by the fact of men being admitted from blocks where there were no defects in the latrines. A water epidemic would have been more general and sudden at Ranikhet, for the water is distributed from a single source of supply, or supposed to be. So would have been an outbreak of 'milk typhoid,' but the milk seems to be 'put out of court' altogether by the following facts:—1, that the men who used it most sparingly were principally attacked; 2, that, with a single exception, the women and children who used it in largest quantities, and from the Sudder Bazaar, escaped altogether; 3, that a man who never took any milk contracted the disease; 4, that there was no evidence to show that the milk had been diluted with *impure* water, and enteric fever is almost certain not to have prevailed in the surrounding villages; 5, because the cases were sporadic and not connected with each other, and arose at irregular intervals with the same milk supply; 6, because the Hindus generally use bazar milk largely diluted with water, and apparently suffer no ill effects."

Brigade Surgeon Tulloch, in referring to the case of a young soldier at Sialkot who had arrived in India last cold season, says: "A solitary case occurring among some 400 men, all subject to the same influences, and existing under the same conditions, offers little chance of throwing light on the origin of the disease, unless some departure from the general course can be shown to have taken place. In this instance nothing in this direction could be determined, and the question why one man out of 400 should be attacked with enteric fever and 399 escape, remains unanswered." Again, Surgeon-Major Berkeley, writing as to the possible cause of the disease amongst men under his charge at Lucknow, says: "I can come to no other conclusion than that the disease was not induced by any insanitary cause existing in the lines," and that "there is no reason to believe that the disease was introduced by the milk used by the men, care always being taken that milk of good quality was issued; and of this even the quantity taken back was very small and obtained fresh in the lines."

Reporting on the epidemic of enteric fever which occurred during May and June amongst the men of the Border Regiment at Dum-Dum, Surgeon-Major Wade writes: "There were eleven cases, all in young soldiers and under one year's residence in India. Every care was taken in investigating each case as it occurred, and it was found impossible to associate it directly or indirectly with faecal contamination of food or water, or with any primary source of infection. There was no question of accuracy of diagnosis in these cases as genuine enteric fever, as, unfortunately, three proved fatal, and the *post-mortem* examination exhibited ulceration and infraction of the Peyerian and agminated glands."

The reports of several other medical officers might be cited, in which similar opinions are more or less expressed; indeed in the majority of instances, where the reporters give evidence of having conducted a close personal inquiry, the foregoing examples may be looked upon as a fair illustration of the results generally. In other instances, however, opinions are less cautiously expressed as to the probable cause. One illustration of this will suffice. Regarding the probable cause of the cases which occurred amongst the men of the Northumberland Fusiliers at Agra, the officer in medical charge writes: "The source was supposed to have been the milk-supply, and there is no doubt that at one time of the year a supply of this was being imported of an inferior quality, the number of cows milked on the premises being quite insufficient to meet the demands." This regiment arrived at Agra from England in February 1880, and five cases of enteric fever occurred amongst the men during that year. In the year under review five more cases, with three deaths, occurred. In previous annual reports special reference was made to the occurrence of the disease at Agra. With regard to the cases which took place in the fort, it was shown that the milk theory of causation was excluded by the circumstance that the cows were brought into the fort to be milked under supervision; and as to the other cases in the station being due to such a cause, it was stated that it had been advanced that, "were the milk to blame, the disease would appear amongst the women and children, who consume large quantities of it; whereas the fact is not one of them has been admitted with fever." A like result would appear to have been experienced during 1881, no deaths having been ascribed to this disease amongst either the women or the children.

In a special report on the cases of enteric fever which occurred in the Madras Presidency during 1881, Surgeon-General Madden, in considering the causes of them writes: "In the year under review the attention given to the sanitary surroundings, and the food and drink of the troops, was, as usual, systematic and continuous. In six out of the nine cases recorded, the origin of the attacks could not be connected with any insanitary conditions, and in three instances certain points were noticed in connexion with their history as possible causes." No very definite opinion, however, appears to have been expressed by any of the reporters as a result of personal inquiry.

Writing of the cases of enteric fever which occurred amongst the troops in the Bombay Presidency during the year, the Surgeon-General, Her Majesty's Forces, expresses himself as follows:—"As regards the means by which enteric fever is propagated among the troops in this country, there has been no addition made to our knowledge since the date of last report." The remarks referred to are probably those quoted in paragraph 42 of this Office Annual Report for 1880, concluding with the following sentence: "In no instance of the cases recorded could the disease be traced to any certain cause—known sanitary defects do not exist in or near the troops' lines; but in most of the bazaars and native villages the conditions are to be found favourable to the production of enteric fever. These are believed to be malaria and exposed faecal deposit."

Dengue.

So far as our statistical records show, dengue was observed for the first time in this country in 1872. In that year the troops in the three Presidencies suffered from this disease, and it continued amongst them till the following year. During 1874 and 1875 no cases were returned as dengue, but in 1876 the disease reappeared and gave rise to 669 admissions in Bengal and to six in Madras. From this period no further admissions were recorded, until the year under report, when 120 were reported as having occurred in Bengal, chiefly in those stations which are situated in the Gangetic provinces. The first case recorded in 1881 occurred in February, and there were further cases until September. The maximum number in any one month, 61, occurred in October; in November there were 15 cases, and in December only three.

Bowel complaints.

In 1881 the admission and death-rates from bowel complaints in the army of India equalled 89 and 2·04 per 1,000 respectively, which is about half what they were in the preceding year, the admissions in that year having been 136 and the deaths 4·27. As will be seen from the table at p. 52, the figures for Bengal and Bombay during the year under review are more favourable than during 1880. In Madras the figures for 1881, under both heads, are not so favourable as for the preceding year, though they show a marked improvement over those of the ten-year period, 1870-79.

Apoplexy.

As regards apoplexy also, the admission and death-rates in the army of India during 1881 were about half what they were during 1880, 3·9 and 1·48 per 1,000 respectively, against 6·7 and 2·69. In 1879 and 1880 cases of apoplexy and sunstroke were very numerous amongst the troops in the Punjab, owing to the large proportion of men who were exposed in camp or on the march during that period. During the year under report, the mortality from this cause in the Punjab fell to less than half what it was in

1880. The largest number of deaths at any one station during 1881 occurred in one of the garrisons of the Punjab group, at Meean Meer, where 12 deaths from apoplexy out of 26 admissions were registered. The admissions were lower in all the Presidencies, and in Bengal and Bombay the deaths were nearly half what they were in 1880, while in Madras the mortality was slightly higher, though the ratio itself was lower here than in either of the other two Presidencies.

Of the chief diseases, hepatitis was the only one which, during 1881, yielded a higher death-rate than the preceding year,—1·60 per 1,000 against 1·34. The increase was, however, very trifling, and the admission-rates are nearly identical. In Madras hepatic diseases in former years have prevailed to a greater extent than in the other Presidencies. The returns during the last two years have been very favourable, and especially so as compared with the average annual admission and death-ratios of the preceding ten-year period.

Hepatitis.

During the year under review there were 103 deaths from diseases of the respiratory organs in the army of India, against 175 in 1880. The number returned from any single station during 1881 was not large, and the ratios for each of the three Presidencies were lower than in the preceding year. As compared with the ten-year period 1870–79, the figures for Bengal and Madras do not present any marked difference; but the ratios for Bombay are somewhat higher. In 1880 the Bombay statistics under this heading were very unfavourable, but this was owing to their having included the troops in Afghanistan.

Respiratory diseases.

For a number of years the Lock Hospital system has been very generally enforced in the cantonments of the three Presidencies, but year by year it becomes more and more evident that, however successful such a system promised to be when it was originally adopted, its practical working in this country has proved a complete failure. Taking the statistics of the last 12 years, during which the returns of the army of the three Presidencies have been tabulated on the same plan, and during which period also the Lock Hospital system has been very generally adopted, it is found that the admissions into hospital from venereal diseases are as great as ever. Indeed, the ratio of the year under review for the army of India, 260 per 1,000, is, with the single exception of that for 1878, the highest on record. It is 10 per 1,000 higher than it was in 1880, and 57 higher than was the average annual ratio of the preceding 10 years, 1870–79. In the Bengal Presidency the admission-rates during 1880 and 1881 were 67 per 1,000 higher than the average of the preceding decennium; and 10 per 1,000 higher than the annual average ratio of the period 1860–69, which comprises several years during which there were no lock hospitals, and terminates before the system had been so generally introduced as it has been since. What has been said regarding the results of the working of the system in Bengal may, so far as data are available, be said with equal truth regarding those of Madras and Bombay, as may be gathered from the following summarised comparative statement:—

Working of lock hospitals.

Admissions from Venereal Diseases in the Three Presidencies.

PROVINCE.	ADMISSIONS PER 1,000.			
	1860–69.	1870–79.	1880.	1881.
Bengal - - - - -	265	209	276*	276*
Madras - - - - -	—†	198	275	258
Bombay - - - - -	—†	191	269	261*
INDIA - - - - -	—	203	250	260

* Excluding troops in Afghanistan.

† The statistics of Madras and Bombay for these years are not available.

Two thousand two hundred and forty-one men of the army of India were invalided during the year, which is equal to 38·36 per 1,000 of the strength. The statistics of invaliding for 1880 were incomplete, owing to non-receipt of the returns of several corps, and consequently no satisfactory comparison can be made under this head between the figures of the year under report and those of the previous year. The ratio of invaliding which was returned for 1880, 26·31, was considerably below the truth. Of the total of 2,241 men invalided in 1881, 778 were recommended for discharge from the service and 1,463 for change. During the 10 years, 1870–79, the ratios of invaliding from all causes have varied from 38·90 in 1876 to 51·02 in 1870; and the annual average for the period was 43·04, or about 4½ per 1,000 higher than the ratio for 1881.

Invaliding.

The proportion of invaliding in the three Presidencies was as follows:—In Bengal the ratio was 36·92, in Madras 27·91, and in Bombay 53·35. The average annual ratios during the ten-year period, 1870–79, were 41·40 in Bengal, 48·71 in Madras, and 42·79 in Bombay. It will thus be seen that the ratio for 1881 in Bengal was somewhat lower than the ten-year average, and that it was very much lower in Madras. In Bombay it was more than 10 per 1,000 higher.

After “anæmia and general debility” the chief causes of invaliding in the army of India during the year were hepatitis 2·96 per 1,000, dysentery and diarrhœa 2·83, and phthisis 2·21. In Bombay a considerably larger proportion was invalided from fevers and bowel complaints, though possibly these diseases may have been to a larger extent included under “anæmia and general debility” in the other Presidencies, and thus less prominence been given to them than in Bombay.

Influence of
age and
length of
service.

Of the total number invalided in the army of India during 1881, 33·74 per cent. were under 25 years of age as compared with 35·84 per cent. in 1880; and 34·58 per cent. were from 25 to 29 years of age as compared with 30·23 during the same period. As already remarked, however, the invaliding statistics for 1880 were not sufficiently complete to permit of satisfactory comparisons with those of other years. With regard to the effect of residence in the country, it is to be remarked that 14·00 per cent. of the total invalided had been less than two years in India, and 30·20 per cent. had served in the country from two to five years. The percentages during 1880 for the same ages were 31·12 and 36·54 respectively.

The sanitary statistics of regiments also are materially affected by the length of time they have been in India. From the subjoined abstract it will be seen that under every heading, with the exception only of hepatitis, the statistics of newly-arrived regiments were more unfavourable than those of the army generally. The total death-rate was nearly 6 per 1,000 higher, and the death-rate from enteric fever 8 per 1,000 higher.

Experience of newly-arrived Regiments in 1881.

	Strength.	RATIO PER 1,000 OF STRENGTH.							
		Admission-rate.	Daily sick-rate.	Death-rate.	DEATHS FROM				
					Enteric Fever.	Other Fevers.	Apoplexy.	Dysentery and Diarrhœa.	Hepatitis.
Army generally	58,728	1,605	70	16·86	2·64	·72	1·48	2·04	1·60
New Regiments	5,542	1,814	75	23·64	10·65	·90	1·80	2·17	1·08

Intemper-
ance.

The returns intended to show the extent of intemperance among European troops in the three Presidencies have been discontinued, and it is thus no longer possible to give the information on this subject which has been given in former reports. Had the information been accurate the want of it would be a serious loss, but the marked discrepancies in the figures regarding different regiments afforded strong evidence that the returns were not prepared on a uniform principle, and that they were consequently of little value as an index of the extent of intemperance.

Sickness and
mortality
among
women and
children.

During the ten-year period, 1870–79, the average annual strength of the women in the army of India was 6,029, and that of the children 11,162. During the period the mortality amongst the women equalled 25·01 per 1,000, and that amongst the children 69·04. From 1875 there has been a gradual decrease in the number both of women and children, until in 1881 they numbered 3,741 and 6,548 respectively, or little more than half what they did in 1875, namely, 6,335 and 12,359.

The death-rate of the year amongst women, 25·93, was nearly 5 per 1,000 higher than it was in 1880, but the mortality amongst the children, 60·17, was nearly the same as in the preceding year. The chief cause of the increased death-rate amongst the women was cholera, from which disease 4·01 per 1,000 died, against 1·69 in 1880. Enteric fever contributed only three deaths amongst the women, or 0·80 per 1,000 against 2·64 amongst the men.

As regards the mortality amongst women in the different Presidencies, Bengal occupies the highest place, with 29·30 per 1,000; Bombay comes next with a ratio of 24·60. In Madras the death-rate was 18·89. The Presidencies stood in the same order in this respect last year. Of the fifteen deaths from cholera which occurred amongst the women of the whole army in 1881, 10 took place in Bengal, five having occurred at a

family camp in the Murree hills. There were no deaths from enteric fever recorded amongst the women either in Bombay or Madras.

The three Presidencies stand in the same order as regards the mortality amongst children as they stand in regard to the mortality amongst women—Bengal 67·17, Bombay 66·56, and Madras 38·68. In 1880 the ratios for the Presidencies were 66·56, 51·58, and 51·77, respectively. The ratios of both these years are lower than the average annual death-rate for the preceding decennium, 75·57 for Bengal, 67·51 for Bombay, and 55·32 for Madras.

Amongst the death causes of children convulsions stood highest; to this, indeed, about one-sixth of the total deaths was ascribed. Diarrhœa stood next, under which heading, along with dysentery, another sixth of the mortality has been returned. The remaining two-thirds of the deaths were due, in order of frequency, to debility, bronchitis, measles, dentition, fevers, and other causes. There were 20 admissions, with nine deaths, from cholera in Bengal, but none in Madras or Bombay. There was not a single death from small-pox amongst the children of the whole army. The same immunity was observed during 1880.

The average annual mortality amongst children during the ten years 1870–79, 69·04 per 1,000, was made up chiefly of the following: convulsions 11·17, diarrhœa 12·84, anæmia and atrophy 7·97, detention 7·31, &c. The death-rate from cholera was 2·64, from measles 2·58, and from small-pox only 0·20.

Out of 3,713 officers of both services borne on the strength of the army of Bengal, either serving in the country or on leave, 70 died, which is equivalent to 18·85 per 1,000. In 1880 the death-rate recorded was 21·96. The ratio for officers of the British service during 1881 was 20·10 against 23·93 in 1880, and that for officers of the Indian service was 17·48 against 19·79, respectively, for the same periods.

Mortality of Officers.

Native Troops.

It is satisfactory to have to record that the mortality amongst the native troops of the army of India during 1881 was but little more than one-half what it was in 1880 or 1879. During the last five years the statistics of these troops for each of the three Presidencies have been prepared in this office—1877 to 1881—and a summary of the principal data is given in the subjoined tabular statement:—

Sickness and mortality among Native troops.

YEAR.	RATIO PER 1,000 OF					Mortality including Absent Deaths.
	Average Strength.	Admissions into Hospital.	Daily Sick.	Deaths from		
				Cholera.	All Causes.	
1877 - - - - -	113,966	1,030	32	1·53	10·90	13·38
1878 - - - - -	117,273	1,460	43	2·06	18·04	21·02
1879 - - - - -	121,107	1,735	58	4·61	35·15	37·79
1880 - - - - -	126,385	1,515	56	0·53	39·22	41·12
1881 - - - - -	114,612	1,305	46	0·97	19·24	22·62
Means of the five years -	118,660	1,422	48	1·94	24·90	27·40

From the above it will be seen that the total mortality, including the deaths which occurred amongst men absent from their corps, fell from 41·12 per 1,000 in 1880 to 22·62 in 1881; and the ratio amongst men actually present with their regiments fell from 39·22 to 19·24 in 1881. Moreover, the admission-rate declined from 1,545 to 1,305, and the daily sick-rate from 56 to 46. Under every heading the ratios for 1881 are considerably lower than the means of the quinquennium ending with that year.

Speaking generally, nearly half the admission-rate was due to paroxysmal fevers, and one-third of the death-rate, or 6·52 per 1,000, was due to diseases of the respiratory organs. The mortality from this cause may be due, in great part, to complications arising in the course of malarial disease. Of the death-rate of the year, 2·76 per 1,000 is ascribed to fevers of all kinds—316 fever casualties, of which 11 were returned as enteric. There were 111 deaths from cholera against 67 in 1880, and 578 in 1879. The remarkably small mortality from small-pox amongst native troops is to be accounted for by the fact that most of the men have already had the disease in early life. In 1879 there were 11 deaths recorded from this disease, 15 in 1880, and only 12 in 1881.

Bengal
army.

About one-third, or 38,721 men of the native army of India, belong to the Bengal Presidency, and of these nearly 2,000 were on service in Southern Afghanistan. With regard to the troops in cantonments, the statistics for 1881 compare very favourably with those of the preceding year; the admissions were 1,495 against 1,609, the daily sick 51 against 65, and the mortality 19·76 against 33·85. Even the comparatively favourable ratios of 1881, though lower than those of the preceding three years, are, nevertheless, higher than the averages under the same headings of the ten-year period 1867-76, as will be seen from the following statement, in which the leading features of the statistics of this period are given along with those of subsequent years :—

YEAR	Average strength.	RATIO PER 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily sick.	Deaths from		
				Cholera.	All causes.	
1867-76	395,081	1,360	42	2·12	13·84	17·25
1877	39,649	1,097	34	0·35	10·32	13·63
1878	41,116	1,645	49	2·09	22·59	25·57
1879*	31,116	2,023	68	2·80	31·78	53·61†
1880*	30,365	1,609	65	1·52	33·85	53·15†
1881*	86,896	1,495	51	0·92	19·76	27·73†

* Excluding troops in Afghanistan.

† These ratios are calculated on the total regimental strength, including the army in Afghanistan.

There was a diminished mortality in this Presidency under nearly every heading during 1881, though the decrease was most marked under respiratory diseases, from 7·21 in 1880 to 6·59 per 1,000 in 1881; fevers from 9·19 to 3·12, and bowel complaints from 6·13 to 2·74. There was also a decrease in the mortality from cholera 0·92 against 1·52. Six cases of enteric fever, with three deaths, were returned during 1881, and 19 cases of small-pox with only one death.

Of the five geographical groups into which the cantonments of this Presidency have been divided, the Agra and Central India group presents the lowest death-rate, 9·35 per 1,000, and also the most marked decrease as compared with the ratio of 1880 was 28·52. In every group, however, there has been a marked decrease in the death-rate, and in nearly every group the admissions into hospital were lower than they were during 1880, as will be seen from the subjoined statement for a series of years :—

YEAR.	RATIO PER 1000.									
	Bengal Proper and Assam.		Gangetic Provinces.		Rohilkund and Meerut.		Agra and Central India.		Punjab.	
	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.
1867-76 -	1,522	14·13	1,061	8·38	987	11·19	1,588	9·61	1,459	14·24
1877 -	1,491	19·64	768	5·19	641	9·52	905	7·41	1,248	8·85
1878 -	1,527	22·13	1,036	7·88	1,007	9·83	1,580	12·96	1,896	18·33
1879 -	1,816	25·57	1,658	11·05	2,038	36·17	2,302	16·07	2,172	47·64
1880 -	1,757	40·63	1,222	20·50	1,395	24·46	1,884	28·52	1,687	38·02
1881 -	1,772	22·53	1,260	15·78	1,378	15·67	1,380	9·35	1,521	28·86

It will be observed that, as regards the Punjab especially, a most satisfactory improvement took place, both in respect to admissions and deaths, when compared with the ratios of the two preceding years. The admissions amongst the troops in Bengal Proper and Assam continue to be high, though the mortality, 22·53, is but little more than half the ratio for 1880.

Fevers occupy the first place as causes of admissions into hospital, and the highest ratios from these were returned from the Bengal Proper and Assam groups. In this group, also, bowel complaints were from two to four times more prevalent than in the other groups. Respiratory diseases likewise, were exceedingly prevalent in this group, and all the other forms of sickness in which malaria plays a prominent part. This feature in the sanitary history of the group will be seen from the figures in the subjoined table, which also gives the chief causes of admissions into hospital in all the groups :—

GROUPS.	RATIO OF ADMISSIONS PER 1,000 OF STRENGTH.					
	Fevers.	Bowel Complaints.	Spleen Disease.	Respiratory Disease.	Rheumatism.	Abscess and Ulcer.
Bengal and Assam - -	892	204	24	104	51	121
Gangetic Provinces - -	612	73	22	61	52	111
Rohilkund and Meerut - -	681	50	9	65	51	135
Agra and Central India - -	687	49	15	62	42	183
Punjab - - -	871	89	14	91	42	107

The malarial character of the diseases in the Bengal and Assam group becomes even more evident from an examination of the mortality returns; for, out of a total death-rate of 22·53 per 1,000, fevers, bowel complaints, and respiratory diseases contributed in very nearly equal proportions, just one-half. The death-rate in the Punjab was almost identical with that in Bengal and Assam, but here nearly half the total ratio was contributed by respiratory diseases alone. In 1880, also, the mortality from this cause was very high in this group of cantonments. There were no deaths from cholera in the Agra and Central India group, and the mortality from this disease in the Punjab was only half what it was in 1880. As regards dysentery and diarrhoea, also, the ratio has fallen from 7·76 to 2·92.

Chief Causes of Mortality in the several Groups of Cantonments of the Bengal Presidency during 1881.

GROUPS.	RATIO PER 1,000.				
	Cholera.	Fevers.	Bowel Complaints.	Respiratory Diseases.	TOTAL.
Lower Bengal and Assam - -	1·23	3·83	3·99	3·83	22·53
Gangetic Provinces - -	1·35	2·03	1·70	2·20	15·78
Rohilkund and Meerut - -	1·25	2·30	2·09	5·43	15·67
Agra and Central India - -	—	1·25	0·62	4·05	9·35
Punjab - - -	0·68	3·79	2·92	10·13	22·86

As regards the admission-rates at the individual stations of the Presidency, Dharmasala stood highest, with a ratio of 2,752, of which 2,142 were from fevers. Of the other larger stations, Delhi returned the next highest ratio, 2,732, over 2,000 per 1,000 in this instance also having been from fevers. Four other of the larger stations returned admission ratios of over 2,000—Meean Meer, Alipore, Barrackpore, and Dinapore.

As regards mortality, two stations returned a death-rate amongst men present with their regiments, of over 50 per 1,000 during 1881—Nowshera 53·18, and Fyzabad 50·82. At Nowshera, out of a total of 41 deaths, 22 were ascribed to fevers and 12 to respiratory diseases. At Fyzabad, out of a total of 31 deaths 13 were registered as due to splenic disease and to anæmia and debility, 4 to bowel complaints, and 3 to fevers. In 1880 the mortality at Fyzabad was 96·97, or nearly twice the high ratio of the year under report. None of the other stations call for any special remarks except Peshawar and its outposts, where out of a total of 90 deaths, 55, or considerably more than one-half, were ascribed to diseases of the respiratory organs.

The statistics of the Bengal troops on service in Southern Afghanistan show a very high mortality. Of the 1,825 men who were thus employed, 194 died during the year, equal to a ratio of 106·30 per 1,000, or more than five times the average amongst the Bengal troops in cantonments. Of the total deaths 55 were due to respiratory diseases, and 57 to bowel complaints; considerably more than half the total mortality was therefore returned under these two headings. The deaths from paroxysmal fevers were also numerous, 24; and anæmia and debility, 11. By adding the deaths from these causes, it will be seen that 147 of a total of 194 were due, more or less directly, to malarious influences. There was no cholera and no enteric fever amongst these troops; and only one death from small-pox. The admission-rate, 1,475 per 1,000, was by no means high, as compared with the excessive mortality; for, as will be seen from the above cited table, the percentage of the deaths to the cases treated was, in several instances, exceedingly high. It may be noted that there were no admissions from guinea-worm.

The statistics of the Punjab Frontier Force show that out of an average strength of about 10,000 men in cantonments, there were 185 deaths during the year—equal to 17·95 per 1,000, about 6 per 1,000 lower than the ratio for 1880, and 14 per 1,000 lower than it was in 1879. Among the principal causes of mortality, diseases of the respiratory organs occupy the highest place, as they were also the principal causes of mortality amongst the troops, both European and Native, serving in the Punjab Frontier. Nearly one-half the total mortality, or 88 deaths, were attributed to these diseases; 24 were returned as due to intermittent, remittent, and continued fevers, in addition to which five deaths, out of six admissions, were ascribed to enteric fever. Three of these deaths from enteric fever occurred at Kohat and outposts.

On the whole, the most favourable statistics furnished by any corps in India during 1881 were those of the Hyderabad Contingent and of the Central India Regiments. With regard to the latter, the sick-rate was only 26, and the admissions only 815 per 1,000. Out of a strength of some 5,000 men, there were only 61 deaths, or equivalent to 12·11 per 1,000, a ratio less than half what it was in 1879 or 1880. Nearly one-half, or 27 of the total deaths were due to respiratory diseases; 12 to fevers, one being from enteric fever; and the remainder to the usual causes of mortality. There was no case of cholera, and only three cases of small-pox, with no death, during the year. There were 152 admissions from guinea-worm, 99 of which were admitted during March, April, May, and June. During the two first and the four last months of the year there were only 17 such cases admitted into hospital.

The statistics of the Hyderabad Contingent are even more favourable than those of the Central India Regiments. The mortality of the year, 7·78, was almost identical with what it was during the two preceding years; the admissions into hospital were only 673 during 1881, against 1,030 in 1880. The details of the admissions and deaths do not call for any special remarks, except that there were 12 admissions, with 4 deaths from cholera, and 56 admissions from Guinea-worm, during the year, half of which occurred during March, April, and May. There were six cases of small-pox, but no deaths.

Madras
army.

Of the regular troops in the three Presidencies during 1881, the army of Madras furnished, as a whole, the most favourable results. The admission-rate was 997 per 1,000, the daily sick-rate 41, and the mortality amongst men present with their regiments 12·02, or including absent deaths, 16·75. As compared with the statistics of 1880, there was an improvement under each of the above headings, the admission-rate was about 400 per 1,000, the sick-rate 13 per 1,000, and the total mortality above 3 per 1,000 lower than in that year. The exact figures are given in the accompanying statement, as also those for all the preceding years, which have been prepared in this office:—

YEAR.	Average Strength.	RATIO PER 1,000.				Mortality, including absent Deaths.
		Admissions into Hospital.	Daily sick.	DEATHS FROM		
				Cholera.	All causes.	
1877 - - -	28,304	861	28	2·79	11·80	14·36
1878 - - -	28,728	841	29	2·23	12·25	15·49
1879 - - -	27,314	1,269	43	3·19	18·89	21·23
1880 - - -	28,710	1,399	54	0·10	15·57	19·54
1881 - - -	28,533	997	41	1·37	12·02	16·75

Nearly one-half of the admissions of the year amongst the troops of the Madras Presidency was due to fevers. In this statement fevers of all kinds are included, though, as regards enteric fever, it should be noted that only one case was recorded, and that this case proved fatal. There were 76 admissions from cholera against 4 in the preceding year, and 49 from small-pox against 26 in 1880. Of the 343 deaths which occurred amongst these troops, 51 were due to fevers, 42 to bowel complaints, 33 to atrophy and anæmia, and 45 to respiratory diseases; so that about one-half the total mortality is attributable to these causes. There were 39 deaths from cholera, 11 of which occurred in August and 16 in December. There were only four deaths from small-pox, all in the first half of the year, and, as already observed, only one death from enteric fever. With the exception of cholera, there has been a decreased mortality under nearly every heading. To dropsy 29 deaths were attributed, against 24 during

1880; but of the 29, twenty were due to beri-beri. This latter disease appears to have prevailed more or less generally throughout the year.

Of the larger stations of this Presidency, Bellary returned the highest admission-rate, 1,792 per 1,000. In the other stations the admission-rate was comparatively low. Amongst the Madras troops at Banda the admission-rate was 1,820 per 1,000; and in Burma also, the admissions at two stations were high—at Rangoon 1,569, and at Shoaygheen 1,729. In the large cantonment of Bangalore the admissions were only 563 per 1,000, and at Mangalore only 391. Of the 76 cases of cholera which occurred amongst the troops of the Presidency, 24 took place at Kamptee, 16 having been during the month of August, and 39 at Trichinopoly, during November and December. The admission-rate amongst the troops at the Andamans fell from 2,118 in 1880 to 1,417 in 1881. Five of the larger stations, in which troops of this Presidency were located, returned death-rates exceeding 20 per 1,000, Rangoon, 32·66, which was almost identical with the ratio for 1880; Vizianagram, 23·65; Kamptee, 21·82; Trichinopoly, 21·65; Vizagapatam, 20·93. With the exception of Kamptee and Trichinopoly, the chief causes of mortality corresponded very closely with the chief causes of admission as above mentioned; but at Kamptee, out of a total of 25 deaths, amongst men present with the regiment, 14 were due to cholera; and at Trichinopoly, out of a total of 40 deaths, 18 were from this disease.

Out of an average strength of 24,945 men, composing the native army of Bombay, over one-fourth was on service in Southern Afghanistan during the year under report. As regards the troops which were in cantonments, the results for 1881, though favourable, were not so much so as were those of Madras, when compared with 1880. Although the admissions fell from 1,283 in 1880 to 1,166 in 1881, and the daily sick from 45 to 41, the mortality amongst men present with their regiments rose from 10·44 to 14·01. When absent deaths are included, the ratio for 1881, 25·93 per 1,000, is less than half what it was in 1880. It must, however, be borne in mind that, as both these death-rates are calculated on the total strength, they include the troops in Afghanistan, and consequently the mortality of 1880 includes also the 690 men who fell at Maiwand and Deh Khoja. Taking the figures of the last five years, it may be stated, generally, that those referring to the sanitary history of the troops in the cantonments of Bombay during 1881 occupy an average position, as may be seen by a glance at the following comparative statement:—

YEAR.	Average Strength.	RATIO PER 1,000.				Mortality, including absent deaths.
		Admissions into Hospital.	Daily Sick.	DEATHS FROM		
				Cholera.	All Causes.	
1877	29,388	1,074	33	1·93	10·90	12·96
1878	23,672	1,702	45	2·36	15·12	17·95
1879	22,854	1,663	51	3·11	20·22	21·90
1880*	15,328	1,283	45	—	10·44	56·53†
1881*	18,849	1,166	41	1·85	14·01	25·93†

* Excluding Afghanistan. † These ratios are calculated on the total regimental strength, including the army in Afghanistan.

Nearly one-half the admissions into hospital amongst troops in cantonments were due to intermittent fever. There were 50 admissions from cholera, 14 from small-pox, and 4 from enteric fever, but no deaths from either of the two latter diseases. There were 251 admissions from guinea-worm, 153 of which occurred in March, April, May and June—these months being, speaking generally, the months of greatest prevalence in the Madras Presidency also. Of the 257 deaths amongst men present with their regiments in cantonments, 61 were ascribed to diseases of the respiratory organs, 47 to fevers, and 25 to bowel complaints. More than half the total mortality was returned under these three headings. There were 34 deaths from cholera.

Of the larger cantonments in the Bombay Presidency, Mehidpur and Admedabad returned the highest admission-rates, 1,901 and 1,644 per 1,000, respectively, considerably more than half the ratio in both instances being due to fevers. The troops stationed in the Persian Gulf were extremely sickly, the admission-rate having been 2,457 per 1,000. The chief causes of admissions, besides fevers, were diseases of respiratory organs, rheumatism, and bowel complaints. The average strength, however, was small,

only 153. There were 22 cases of cholera at Surat in May, and 12 in Bombay during June, July and August. The admission-rate at Aden was 887 per 1,000, only 168 of which were due to fevers; the death rate was 13·31. Judged by the death-rate, Surat was the most unhealthy station in the Presidency, having returned a mortality ratio of 40·76. Of this ratio, however, 19·02 was due to cholera. The only other stations which returned a ratio exceeding 20 per 1,000 were Karachi, 24·56, and Ahmedabad, 20·54. Out of a total of 22 deaths at the latter station, five were from cholera. The mortality amongst the troops in Upper Sind was also high, 23·85; there were in all 31 deaths, 23 of which were due to fevers, respiratory diseases, and bowel complaints.

As already observed, over one-fourth of the Native Army of Bombay was in Southern Afghanistan during the whole of 1881. As compared with the troops in cantonments, the returns from Afghanistan are, under each of the general headings, more unfavourable. The daily sick was 76 per 1,000, as compared with 41 in cantonments; the admissions 2,317, as compared with 1,166; and the mortality 57·76, as compared with 14·01. There were no cases of cholera among this part of the army, and only seven cases of small-pox, of whom two died. Two cases and one death are ascribed to enteric fever. Of the 381 deaths amongst these troops in Southern Afghanistan, 218 were due to diseases of the respiratory organs, the greater part of which occurred during the first four and last two months of the year, nearly one-third of the total having occurred in January alone. The ratio of admissions from these causes was 301·2 per 1,000, as compared with 65·9 in cantonments. It was observed, with regard to the Bengal troops in Afghanistan, that no cases of guinea-worm had been registered as having occurred amongst them. Amongst the Bombay troops, however, there were 14 admissions due to this cause, so that it is probable that the parasite was acquired in Bombay previous to the departure of the men for Afghanistan.

Comparison
of the three
Presidencies.

In the following statement the principal statistics of all branches of the Native Army in the three Presidencies have been brought together for convenience of comparison, and, so far as practicable, the figures dealing with the troops stationed in cantonments have been kept apart from those of the troops on service in Southern Afghanistan. As in former years, the first column includes both the deaths which occurred amongst the men present with, and absent from, their regiments, and the ratios have been calculated on the aggregate regimental strength. The second column gives the strength of the men present with their regiments, and on these figures the ratios in the subsequent columns have been calculated.

PRESIDENCY.	Total Deaths per 1,000, including Absentees.	Average Strength present with Regiments.	RATIO PER 1,000 OF STRENGTH.			
			Admissions into Hospital.	Daily Sick.	Deaths from Cholera.	Deaths from all Causes.
Bengal Native Army - - -	27·73	38,721	1,494	52	0·88	23·84
" " (excluding Southern Afghanistan)	—	36,896	1,495	51	0·92	19·76
Madras " - - -	16·75	28,533	997	41	1·37	12·02
Bombay " - - -	25·93	24,946	1,471	50	1·36	25·58
" " (excluding Southern Afghanistan)	—	18,349	1,166	41	1·85	14·01
Central India Regiments - - -	13·34	5,039	815	26	—	12·11
Punjab Frontier Field Force - -	22·64	10,307	1,718	55	—	17·95
Hyderabad Contingent - - -	8·52	7,068	673	24	0·57	7·78
India - - -	22·62	114,812	1,305	46	0·97	19·24

In last annual report a summary of the several regimental sanitary sheets of the Native troops of each Presidency was given. A similar abstract has been prepared for the year under review, to which reference should be made with regard to the chief causes to which medical officers have attributed any exceptional sickness and mortality in the regiments.

Jails.

Sickness and
mortality in
jails.

The year under report is the fifth year for which the statistics of the jails of the three Presidencies have been prepared on a uniform plan by the Statistical Branch of this office. The first three years of this period were characterised by excessive sickness and mortality, not only amongst the prisoners, but also amongst the general population of the country. In 1877, as one of the consequences of the famine which prevailed in

Madras and Bombay, the prison population was augmented to a very great extent, and the sick and death-rates were greatly increased. The effects of this famine continued to be felt in 1878 also in these two Presidencies; moreover, during this year a large portion of the Bengal Presidency experienced severe privation and want, so that as a whole the statistical returns of the jails during 1878 were even worse than were those of 1877. The results of 1879, though better than those of the preceding year, were still extremely unfavourable, and it was not till 1880 that a marked improvement was observed—an improvement which gave rise to the hope that a return was gradually taking place to the condition of ordinary years. The main features of the sanitary statistics of Indian jails for these four years are brought together in the subjoined tabular statement, and compared with those for the year under report :—

YEAR.	Average Strength.	RATIO PER 1,000.					
		Admission into Hospital.	Daily Sick.	Deaths from			
				Cholera.	Dysentery and Diarrhoea.	All causes.	
1872-76 - -	99,758	1,016	?	2·86	13·48	36·24	
1877 - -	110,147	1,017	36	7·81	25·80	61·95	
1878 - -	127,914	1,198	46	5·90	32·76	81·31	
1879 - -	117,680	1,294	49	4·44	27·66	73·73	
1880 - -	106,763	1,213	46	0·74	19·43	48·31	
1881 - -	100,844	1,214	45	3·03	16·92	44·03	

As will be seen from the above figures, the average jail population of India fell from 106,763 in 1880 to 100,844 in 1881. As compared with 1879, the decrease was nearly 17,000, and a decrease of over 27,000 as compared with 1878. It has not been found practicable to give statistics for the whole of India for the years preceding the last quinquennium, which can be properly compared with those prepared in this office from 1877 and onwards; but the figures in the first line of the foregoing statement, giving the mean results of the years 1872-76 (which have been compiled from the several local reports), will suffice to show the general character of the returns during the five years preceding the famine of 1877. The average number of prisoners in British India during the year under report was but little above the mean number of the five years preceding the famine, so that the number for 1881 may be looked upon as something approaching to a fairly normal average for this country. This would imply that, supposing the estimated population of the area comprised in these prison statistics to be about 202,000,000,* and the number of convicted persons to be 100,000, the proportion of prisoners in India to the general population would be about one in every 2,000.

With regard to the sickness and mortality amongst prisoners during 1881, as compared with the preceding year, a reference to the above tabular statement will show that the admission and daily sick-rates were almost identical during both years, 1,214 and 45 per 1,000, as compared with 1,213 and 46 during 1880. The death-rate, however, fell from 48·31 to 44·03 per 1,000. In 1879 the mortality was 73·73, and in 1878 it attained the very high ratio of 81·31, or nearly double the ratio of the year under review. Both the admissions and the mortality, however, are still higher than they were during any of the five years preceding 1877, the highest admission-rate during that period having been 1,056 per 1,000 in 1874, and the highest death-rate 38·54 in 1873. As compared with 1880, the death-rate from cholera during 1881, 3·03 per 1,000, was high, but not as compared with most of the nine preceding years, which are dealt with in the foregoing tabular statement.

Although, as stated in a previous paragraph, the jail population of India, taken as a whole, has greatly decreased in 1881, as compared with that of the preceding four years, nevertheless the decrease in the several Presidencies is far from uniform. This will become evident on examination of the following statistics, in which the strength of the year under report is compared with that of 1878, when the prison population was at its maximum, and with the mean of the five years, 1872-76, preceding the famine :—

* The actual population of India, as ascertained when the census of 1881 was taken, is 218,559,918, but the population of the area over which the jail statistics have been collected, as given in this report, is 202,097,700.

Ratio of Prisoners, per 10,000 of Population, in each of the Three Presidencies, for 1881, 1878, and 1872-76, compared.

PRESIDENCY.	Period.	General Population.*	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of average Strength.
Bengal - - - {	1872-76	148,496,469	68,328	4·6	39·03
	1878	—	78,116	5·3	65·85
	1881	—	63,478	4·3	44·42
Madras - - - {	1872-76	30,839,181	9,607	3·1	32·37
	1878	—	21,315	6·9	125·92
	1881	—	10,332	3·3	41·91
Bombay - - - {	1872-76	16,383,422	8,011	4·9	26·61
	1878	—	13,139	8·0	118·27
	1881	—	9,910	6·0	41·88

* Census of 1881. See Supplement to the *Gazette of India*, September 10th, 1881, page 1081.

The above table shows that the ratio of prisoners to the general population in the Bengal Presidency has decreased from 5·3 in 1878 to 4·3 per 10,000 in 1881; that of Madras from 6·9 to 3·3; and that of Bombay from 8·0 to 6·0. Further, the ratios for Bengal and Madras during 1881 were nearly identical with the mean of the five years preceding the famine; but the Bombay ratio for 1881 is still nearly one-fourth higher than the mean for that period.

As regards the comparative rates of sickness and mortality in the several Presidencies during 1881, the Madras returns are, on the whole the most favourable, Bombay stands next, and Bengal stands third, although, as regards the mortality especially, no great difference is to be noted. In Madras and Bombay the death-rate is almost identical, as will be seen from the subjoined comparative table :—

PRESIDENCY.	Average Strength.	Ratio per 1,000.				
		Admissions into Hospital.	Daily sick.	Deaths from		
				Cholera.	Dysentery and Diarrhoea.	All causes.
Bengal - - - -	63,478	1,151	41	3·10	17·91	44·42
Madras - - - -	10,332	737	28	3·19	20·62	41·91
Bombay - - - -	9,910	1,076	34	3·73	12·01	41·88

With the exception of Bengal Proper, the prison population of each of the several provinces in the Bengal Presidency was, during the last quinquennium, at its highest in 1878. In Bengal Proper, however, the numbers for 1879 were slightly above those for 1878, but in the following statement, showing the ratios of prison strength to the general population during recent years, the figures for 1878 have been taken throughout as representing the maximum of the five-year period, 1877-81. The prison population of the several provinces during the year under report has varied from 2·3 per 10,000 in Bengal to 7·5 in the Punjab. In the North-Western Provinces and Oudh the ratio was 6·2, and in the Central Provinces 3·5. As compared with 1878, the greatest decrease during 1881 has taken place in the North-Western Provinces and Oudh, and there is some decrease in each of the other provinces, with the exception only of Assam, in which there is some increase. In this last province, as also in the Central Provinces, the number of prisoners during 1881 is higher than it was in the five-year period preceding 1877; and slightly so, likewise, in the Punjab. The jail strength of the Presidency, as

a whole, however, was lower during 1881 than the average of the five years preceding the famine in Madras and Bombay.

Ratio of Prisoners per 1,000 of Population in each Province of Bengal, also in Berar and in British Burma, for 1881, 1878, and 1872-76 compared.

PROVINCE.	Period.	General Population.	Prisoners.		
			Average Number.	Proportion to 10,000 of Population.	Deaths per 1,000 of Average Strength.
Bengal Proper - - - {	1872-76	68,829,920	19,082	2·8	53·88
	1878		17,718	2·6	70·89
	1881		16,014	2·3	65·01
Assam - - - {	1876-76	4,815,157	1,015	2·1	51·03
	1878		1,188	2·4	60·61
	1881		1,307	2·7	39·02
N.-W. Provinces and Oudh - {	1872-76	44,107,061	28,345	6·4	31·89
	1878		38,528	8·7	41·3
	1881		27,599	6·2	23·78
Punjab - - - {	1872-76	18,786,107	13,964	7·4	36·67
	1878		15,230	8·1	109·72
	1881		14,075	7·5	65·15
Central Provinces - - {	1872-76	11,505,149	3,323	2·9	36·78
	1878		4,445	3·9	118·11
	1881		4,052	3·5	29·30
Berar - - - {	1872-76	2,670,982	966	3·6	33·34
	1878		1,025	3·8	75·12
	1881		1,272	4·8	16·51
British Burma - - - {	1872-76	3,707,646	4,682	12·6	31·82
	1878		4,748	12·8	57·71
	1881		4,627	12·5	45·82

The daily sick and admission-rates of the Presidency are slightly higher than they

Jails of the Bengal Presidency.

Year.	Average Strength.	RATIO PER 1000.				
		Admissions.	Daily Sick.	Deaths from		
				Cholera.	Dysentery and Diarrhoea.	All causes.
1877 -	63,600	967	30	3·07	10·59	31·68
1878 -	78,116	1,181	40	5·34	28·27	65·85
1879 -	78,901	1,258	48	6·38	30·65	77·90
1880 -	66,751	1,107	40	1·00	21·51	51·12
1881 -	63,478	1,151	41	3·10	17·91	44·42

the aggregate of the jails was almost identical with what it was in the year under report.

As usual, fevers stand first as causes of admissions into hospital in the Bengal Presidency, having contributed not far from one half of the whole. The relative positions in which some of the more ordinary diseases stood as causes of admissions into hospital amongst prisoners, are shown in the accompanying statement, which will also serve to illustrate how little change takes place in their position on the list from year to year. As compared with 1880, the ten causes cited occupy precisely the same position; and, with the exception of the admissions from fevers, which show a considerably increased ratio, the proportion which each contributed to the general admission-rate has undergone but little change :—

Statement showing the Chief Diseases which have caused Admissions into Hospital in the Jails of the Bengal Presidency from 1873 to 1881.

Num- ber.	DISEASES.	ADMITTED PER 1,000 OF AVERAGE STRENGTH.								
		1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Fevers - -	528	458	659	556	370	457	398	445	450
2	Abscess and ulcers -	127	133	114	113	122	115	99	106	110
3	Diarrhoea - -	106	117	112	107	94	86	90	96	107
4	Dysentery - -	105	116	129	136	97	104	95	101	103
5	Respiratory diseases -	48	48	41	44	43	41	37	45	44
6	Wounds and accidents	40	37	35	43	48	38	42	44	42
7	Atrophy and anæmia -	28	29	29	27	23	19	16	14	19
8	Venereal diseases -	20	20	18	18	14	11	20	15	13
9	Rheumatism - -	15	15	14	15	20	17	16	19	16
10	Eye diseases - -	13	14	11	12	12	11	11	12	13
	Total of the 10 -	1,030	986	1,162	1,071	847	899	824	897	923
	Total from all causes	1,151	1,108	1,285	1,181	967	1,017	942	1,027	1,042

As causes of mortality bowel complaints occupied the first place, with 17·91 per 1,000 out of a total ratio from all causes of 44·42. This ratio is lower than any recorded since 1877, but is still higher than in any of the other four preceding years cited in the following tabular statement. The mortality from fevers was slightly increased, and the cholera ratio rose from 1·00 to 3·10 per 1,000. Under all the other headings diminished ratios were recorded, and the proportion of the mortality caused by the 10 causes cited fell from 45·66 to 40·13.

Statement showing the Diseases which have been the Chief Causes of the Mortality amongst Prisoners of the Bengal Presidency from 1873 to 1881.

Num- ber.	DISEASES.	DIED PER 1,000 OF AVERAGE STRENGTH.								
		1881.	1880.	1879.	1878.	1877.	1876.	1875.	1874.	1873.
1	Dysentery and diarrhoea	17·91	21·51	30·65	28·27	10·59	14·75	12·38	16·38	16·63
2	Respiratory diseases -	7·62	9·38	9·53	8·82	5·41	5·45	5·01	6·02	7·00
3	Fevers - -	4·65	4·45	13·82	7·40	1·97	2·36	4·20	3·72	5·47
4	Cholera - -	3·10	1·00	6·38	5·34	3·07	4·24	2·35	2·48	2·97
5	Atrophy and anæmia -	2·58	3·66	5·43	5·01	2·69	2·19	1·65	2·37	1·94
6	Phthisis pulmonalis -	2·24	2·53	3·00	2·76	2·36	3·24	1·86	2·51	2·33
7	Dropsy - -	·68	1·05	0·99	0·83	0·71	0·73	0·67	0·85	0·55
8	Apoplexy - -	·58	·88	0·76	1·02	0·80	0·59	0·52	0·31	0·81
9	Wounds and accidents	·55	·63	0·66	0·95	0·75	0·52	0·62	0·69	0·73
10	Spleen disease -	·22	·57	0·31	0·23	0·20	0·29	0·77	0·37	0·33
	Total of the ten -	40·13	45·66	71·53	60·63	28·55	34·36	30·03	35·70	38·76
	Total from all causes	44·42	51·12	77·90	65·85	31·88	37·51	33·65	39·90	43·08

For the more convenient study of the distribution of disease in this large Presidency, the jails have been arranged into groups in accordance with their geographical positions. The jails of the provinces of Lower Bengal and Assam constitute the first group; those in Chota-Nagpore and in the districts of Dinapore, Benares, and Oudh, the Gangetic Provinces and Oudh group, the second; the third is composed of the jails in the Central Provinces (excluding Jubbulpore and Saugor); the fourth of those in the Agra district and in Central India; the fifth in the Rohilkund and Meerut districts; and the sixth group includes all the jails in the Punjab. The leading facts for 1881 are summarised in the accompanying statement, in which, also, are incorporated similar data as regards the preceding four years:—

Statement showing Sickness and Mortality amongst the Prisoners of the Bengal Presidency (arranged into Groups in accordance with their Geographical Positions) from 1877 to 1881.

GROUPS.		Average Strength.	RATIO PER 1,000.				
			Admissions into Hospital.	Daily Sick.	Deaths from		
					Cholera.	Dysentery and Diarrhoea.	All causes.
I.—Lower Bengal and Assam	1877	14,934	1,391	41	7·97	17·88	49·28
	1878	14,994	1,390	46	6·07	30·01	63·63
	1879	15,851	1,599	52	15·83	44·75	94·46
	1880	14,848	1,635	54	1·89	31·59	63·91
	1881	13,814	1,583	54	4·92	33·74	65·30
II.—Gangetic Provinces and Oudh	1877	21,593	573	20	3·43	8·20	22·74
	1878	27,238	595	21	5·29	14·35	37·59
	1879	24,270	865	29	4·41	17·96	41·78
	1880	20,876	666	26	0·48	15·14	31·95
	1881	19,867	786	29	1·51	13·62	29·90
III.—Central Provinces (excluding Jubbulpore and Saugor).	1877	2,348	943	34	—	13·20	35·77
	1878	3,053	1,266	47	32·75	42·25	132·98
	1879	3,493	866	35	15·74	29·77	77·58
	1880	3,339	970	33	4·79	27·85	59·90
	1881	2,779	863	29	—	12·59	31·67
IV.—Agra and Central India -	1877	4,779	728	34	0·21	4·18	30·13
	1878	6,396	1,204	54	10·32	28·61	76·30
	1879	5,645	1,282	59	—	24·44	67·49
	1880	4,991	1,000	47	1·80	16·63	46·08
	1881	4,877	1,016	43	0·21	6·96	26·04
V.—Rohilkund and Meerut -	1877	7,818	560	20	—	6·40	20·85
	1878	11,204	918	37	0·89	25·97	53·64
	1879	9,901	1,288	58	0·30	23·33	51·71
	1880	8,373	969	42	0·36	9·32	28·31
	1881	8,066	851	38	—	5·46	23·80
VI.—Punjab -	1877	12,129	1,504	37	0·08	10·64	33·80
	1878	15,230	2,192	66	0·39	50·17	109·72
	1879	15,141	1,735	57	4·16	43·99	140·08
	1880	14,324	1,352	42	0·07	27·71	78·82
	1881	14,075	1,519	48	6·96	20·39	65·15

In three of the above groups, Nos. II., III., and V., the admissions into hospital were below 900 per 1,000, and the highest death-rate from all causes was 31·67. The most unfavourable results were furnished by the Lower Bengal and Assam group of jails, with an admission-rate of 1,583 and a death-rate of 65·30, showing a somewhat increased mortality over the high ratio of 1880. All the other groups show improvement as regards the death-rate, and, in some instances, to a very marked extent. The lowest death-rate was registered amongst the jails of the Rohilkund and Meerut group, 23·80 per 1,000, and the next lowest, 26·04, in the Agra and Central India group. Although in the Presidency, taken as a whole, the prevalence of cholera was more marked than during 1880, its distribution, as inferred from the jail statistics, was more general; seeing that, whereas in 1880 it was not absent from any of the groups, two of the groups—Central Provinces and Rohilkund and Meerut—have furnished blank returns under this heading during 1881. The highest death-rate from cholera was returned by the Punjab group, 6·96 against 0·07 in 1880, and the next highest by the Lower Bengal and Assam group of jails, 4·92 against 1·89 during the previous year.

As is very generally the case, the statistics of the Oudh jails, if taken apart from the North-Western Provinces with which it is now incorporated, are the most favourable, the admissions equalled only 514 per 1,000, the daily sick 18, and the total mortality, 15·00. On the other hand, those of Lower Bengal, as is likewise very generally the case, furnish on the whole the most unfavourable—the admission and daily sick-rates being about three times higher than those of Oudh, and the death-rate more than four times higher. The precise figures will be found in the subjoined statement, where the admissions, daily sick, and death-rates of the seven provinces in the Presidency, together with the ratios for British Burma and for the convict settlement at the Andamans, are given for the last five years. The figures for the several provinces have been thus brought together for

convenience of comparison, but they will be dealt with separately when the results in each province come to be considered.

PER 1,000 OF AVERAGE STRENGTH.	YEARS.	Bengal.	Assam.	Oudh.	North- Western Provinces.	Central Provinces.	Punjab.	Berar.	British Burma.	Andaman Islands.
Admissions	1877	1,283	1,382	504	535	907	1,504	937	844	1,687
	1878	1,290	1,629	457	802	1,148	2,192	1,283	897	1,867
	1879	1,573	1,436	743	1,064	859	1,735	951	659	2,346
	1880	1,542	1,173	522	800	973	1,352	942	870	2,492
	1881	1,572	1,305	514	845	790	1,519	825	883	2,308
Daily sick	1877	39	40	16	21	37	37	26	38	76
	1878	42	51	17	32	47	66	43	41	88
	1879	51	46	24	44	35	57	26	28	92
	1880	52	42	18	35	39	42	33	30	112
	1881	52	42	18	38	29	48	24	36	99
Deaths	1877	50·10	56·30	10·56	19·71	45·06	33·80	15·58	56·76	34·30
	1878	70·89	60·61	23·55	46·52	118·11	109·72	75·12	57·71	69·79
	1879	97·57	85·80	19·66	48·45	67·76	140·08	27·30	32·20	47·54
	1880	63·82	52·46	18·19	31·44	60·13	78·82	35·64	24·89	49·65
	1881	65·01	39·02	15·00	26·61	29·30	65·15	16·51	45·82	48·02

The improved character of the statistics of the jails of Lower Bengal during 1880, as compared with those of 1878 and 1879, gave rise to the hope, expressed in last year's annual report, that the general causes which had so unfavourably influenced the vital statistics of this province since 1876 were passing away. The experience of another year, however, has shown that this hope has been but partially realised, and that indeed the statistics of 1881 are somewhat less favourable than those of 1880. The admission-rate has slightly increased from 1,542 to 1,572 per 1,000; the daily sick, 52, is the same, and the death-rate has increased from 63·82 to 65·01. With reference to the higher death-rate, it is to be borne in mind that the mortality from cholera during 1881, 5·54, was 4 per 1,000 higher than it was in 1880, though about 13 per 1,000 lower than the ratio for 1879. Cholera was, thus, far from being exceptionally prevalent; indeed the cholera mortality of the year under report was, with the exception only of the years 1875 and 1880, the lowest recorded since 1871. But what calls for attention, perhaps, more prominently than the continued high death-rate in these provinces, is the persistent increase which is to be noted almost year by year in the admission and daily sick-rates. This feature will be observed from a glance at the statement given in the margin, the ratios of sickness for 1881 being, on the whole, higher than in any of the four years included in the table: they are, in fact, higher than those of any of the ten years preceding the year under report.

YEAR.	Average Strength.	RATIO PER 1,000.				
		Admis- sions.	Daily sick.	DEATHS FROM		
				Cholera.	Dysentery and Diarrhoea.	All causes.
1877*	17,170	1,354	40	8·3	17·0	50·6
1878	17,718	1,291	43	11·85	31·60	70·89
1879	17,771	1,573	51	18·91	45·92	97·57
1880	17,219	1,542	52	1·62	33·02	63·82
1881	16,014	1,572	52	5·54	35·46	66·01

* From the local report.

The local authorities attributed the extremely unfavourable statistics of 1879 to the general adoption of the scale of diet recommended by the Indian Jail Conference of 1877, and which was in force between March 1869 and April 1880. This matter was carefully examined in this Office Annual Report for 1879, and again, and very fully, in that for 1880, and the conclusion expressed in both reports, that the unsatisfactory condition of the Bengal jails was due to other causes than that of insufficient and unsuitable food, is fully borne out by the experience of another year. The question is, beyond all doubt, a very complex one, and the strenuous efforts which are being made by the local authorities to deal with it will, it is earnestly hoped, be crowned with success.

With regard to the chief causes to which the sickness and mortality have been ascribed, fevers and bowel complaints combined, constituted 1,069 out of a total ratio from all causes of 1,572 per 1,000 of the admissions; that is to say, over two-thirds, and 37·64, or more than half of the death-rate. The ratios for the preceding five years seem to indicate that the sickness and mortality have, in the main, been due to like causes.

As has already been remarked, the Punjab stands next to Bengal as regards the unfavourable character of its returns, though, as compared with each of the three preceding years, the results for 1881 in respect of diminished mortality are very satisfactory. The death-rate has fallen to 65·15 per 1,000 from 78·82 in 1880, and 140·08

in 1879. It is, nevertheless, evident that sickness is still very prevalent in the jails of this province, seeing that the admissions during 1881 were equal to 1,519 and the daily sick to 48 per 1,000—higher ratios, under both heads, than those for 1880. It may also be noted that the average jail population of the Province has not undergone any marked diminution; the number of the prisoners during 1881, was equal to 7·5 per 10,000 of the general population.

In last year's annual report attention was drawn to the extremely high death-rates in three of the jails of the Province,—Rupar 104·17 per 1,000, Lahore 101·49, and Rawalpindi 391·75,—and it was observed that, judging from the history of these jails so far as could be ascertained, it would seem impossible to avoid the conclusion that the high death-rate was, at all events to some extent, attributable to agencies at work within the precincts of the jails. As regards the Rupar jail, it was pointed out that the very unfavourable results may have been largely due to the prisoners having been employed in extensive canal excavation works. It is highly satisfactory to have to record that the death-rate at Rupar has fallen to 55·74 per 1,000, or nearly one-half the ratio of the preceding year, and that, as compared with the mortality during 1879, it was less than one-fifth. The results in the other two jails, however, were still very unfavourable, the death-rate in the Lahore central jail having been 157·33 per 1,000, and in the Rawalpindi jail 195·33. As regards the Lahore jail, 46·84 per 1,000 of the total mortality was due to cholera—this disease having been prevalent in the neighbourhood during the year. There was no cholera at Rawalpindi; nevertheless a death-rate of nearly 20 per cent. of the strength was recorded which, though a great improvement on the ratios for the previous two years, still evinces a most unsatisfactory condition. In 1878 the total death-rate at this jail was only 26·35. The causes of the excessive sickness and mortality in this jail, which commenced in October 1878 and continued till April 1881, have recently formed the subject of special correspondence. Whatever may have been the exact nature of the fever which proved so fatal—and on this point there is decided difference of opinion—there can be no question that removal from the jail was imperatively called for, and the beneficial results which followed this movement when it was at last carried out convey an important practical lesson which cannot be too strongly impressed on all jail authorities in India.

In marked contrast to the results in Lower Bengal and the Punjab, the highly satisfactory character of the returns of the North-Western Provinces and Oudh jails may be cited. The daily sick-rate of the combined provinces was only 32 per 1,000, the admission-rate 764, and the death-rate 23·78—the lowest mortality recorded by any of the larger provinces of India. With the exception of 1879, the admission and daily sick-rates have been very low during the last five years, and the most favourable returns of the series under all headings were those of 1877.

The statistics of the jails of the Central Provinces do not call for any special remark, except that like those of the North-Western Provinces and Oudh they were favourable. The death-rate, 29·30 per 1,000, was less than half what it was in 1880, and lower than it had been for several years past. The admission and daily sick-rates, also, were the lowest of the last five years, and there was not a single case of cholera in any of the jails during the whole of 1881.

The sanitary history of the jails of Berar during 1881 is likewise very satisfactory. The rates of admissions into hospital and of daily sick were low, and the mortality 16·51, was less than half what it was in the previous year. The death-rate from bowel complaints was high during 1880—13·82 against 2·36 in 1881. As, however, the aggregate average strength of the six jails in the province is but little over 1,200, considerable fluctuation in the ratios is to be expected.

During 1880 the statistics of British Burma were, on the whole, the most satisfactory of any Indian province; the death-rate was only 24·89, and the admission and daily sick-rates 871 and 30 per 1,000. Statistics show that whereas during 1881 there was but little increase in the admissions, the mortality, 45·82, had nearly doubled; out of a total of 212 deaths which occurred in the jails of the province, considerably more than one-half was returned from two jails—67 at Thayetmyo and 64 at Moulmein. Of the deaths at Moulmein, 27 were due to cholera; and of those at Thayetmyo, 50 were due to an epidemic of beri-beri, which prevailed from July to October. In all there were 38 deaths from cholera; and were these, together with the deaths from beri-beri, excluded from the statistics, the death-rate for the province would be only 26·8, or only 2 per 1,000 higher than the low ratio of 1880.

Mr. Bernard, the Chief Commissioner, in his resolution on jail administration during the year, thus sums up the information which had been collected concerning the outbreak of beri-beri: "Efforts to check the ravages of the disease failed until the

“ month of October, when a large number of prisoners were released and the remainder
 “ were transferred to Moulmein. This measure proved completely successful; not a single
 “ fresh case appeared, and not a single death occurred among the prisoners transferred.
 “ The etiology of the disease is at present but little understood. It was, however, proved
 “ before the Medical Committee, which was convened by the Chief Commissioner to
 “ inquire into the circumstances of the outbreak at Thayetmyo, that, during part of
 “ the year, the quality of the prisoners' rations was not so good as it should have been;
 “ that the clothing had been insufficient, and that the water from the jail wells
 “ contained an undue proportion of lime and magnesia. The Inspector-General is of
 “ opinion that these circumstances affected the health of the prisoners and predisposed
 “ their constitutions to receive the poison which produces beri-beri. Mr. Kelly is of
 “ opinion that this poison is conveyed in the exhalations of the soil, and accordingly,
 “ under his advice, orders have been issued that all wards and verandahs of the jail
 “ should be asphalted. It has been ascertained that a part of the ground occupied by
 “ the jail was formerly a burial-ground. Whether this circumstance conduced in any
 “ way to the outbreak it is impossible to say, but all soil impregnated with, or
 “ consisting of, organic matter is being removed and replaced by good, pure soil from
 “ outside. The water for the prisoners is now being obtained from the river, and due
 “ attention is being paid to the food and clothing of the prisoners. Two facts in
 “ connexion with beri-beri may be held to have been established—(1) that a complete
 “ change of air forms the only known method of checking the disease; and (2) that the
 “ disease is not contagious.”

The returns of the Assam jails, like those of the Punjab, show a comparatively low death-rate, 39·02, as compared with the high admission and sick-rates, 1,305 and 42 per 1,000 respectively. There was an increase in the admissions, and a decrease of over 13 per 1,000 in the deaths, notwithstanding that the mortality from cholera was 7·65 as compared with 0·79 during 1880. There is nothing in the sanitary history of the year in this province which calls for special remark.

The average strength of the jails of the Madras Presidency during the year under report, 10,332 prisoners, was less than half what it was in 1878, and some 1,300 less than it was in 1880. Since the famine of 1877, when the mortality in the jails rose to 176·01 per 1,000, there has been a gradual improvement, until in 1881, the mortality, 41·91, is slightly lower than it was in the year preceding the famine. It is, however, still nearly 10 per 1,000 higher than the mean of the five-year period preceding 1877. The admission and daily sick-rates were comparatively low, and somewhat lower than those of 1880.

The death-rate from cholera in the Presidency, 3·19, during 1881 was high as compared with the preceding year, owing chiefly to an outbreak of the disease which took place in November and December in the Trichinopoly central jail. All the deaths from cholera returned as having occurred amongst the prisoners of this Presidency, a total of 33, took place at Trichinopoly, 32 in the central and one in the district jail. Of the 125 deaths which occurred in the Trichinopoly central jail, 112 were due to cholera, dysentery, and diarrhoea; and it was to deaths from these causes that the deplorably high mortality of the year at this large jail, 121·36, is chiefly due. Judging from the reports which have been received in this office regarding this outbreak, it would appear that the local authorities were not sufficiently alive to the importance of early movement into camp. It appears that the first case occurred on the 14th November; but no movement was made till the 20th November, when 20 cases had occurred, and then it was only a partial movement to the jail garden: the jail was not vacated until the 8th December, when 84 cases of the disease had been admitted into hospital. The localised character of cholera, and the consequent necessity for early movement, are facts which ought never to be lost sight of in dealing with this disease.

During the last two years the rates of mortality in the jails of the Bombay Presidency have been almost identical with those of the Madras Presidency, though the admission and daily sick-rates have, on the whole, been considerably higher. During the year under review, the admissions were 1,076, and the daily sick, 34 per 1,000. The mortality equalled 41·88, against 45·16 in 1880. The mortality of the last two years was considerably less than half what it was during 1878 and 1879, and there was a decrease in the average strength during 1881 of nearly 25 per cent. as compared with 1878. During 1880 there was a marked exemption from cholera in the jails of this, as of other Presidencies. There were only 5 deaths from the disease against 37 in 1881. Of these, 18, or nearly one-half, took place in the Surat jail between the months of May and August. The occurrence of this outbreak raised the mortality in this jail to 138·76, the highest ratio of any jail in the Presidency. Excluding the deaths from cholera, the mortality from all other causes equalled 52·64. The heavy mortality which during

recent years, has been reported in connexion with the Gokak gang of prisoners employed in making extensive canal excavations, has fallen during 1881 to 112·80 per 1,000, against 156·36 in 1880, and a maximum of 401 per 1,000 in 1878. In all the years the chief causes of death were dysentery and diarrhoea, and to these diseases 25, out of a total of 52, deaths during 1881 were attributed.

For some time past the unhealthy condition of the convicts deported to the Penal Settlement at the Andamans and Nicobars has occupied the serious attention of the local authorities and of the Government of India. It is much to be regretted that the health statistics of 1881, though manifesting some, do not on the whole show any marked improvement over those of the preceding three years. The admissions into hospital were exceedingly high, 2,308 per 1,000, against 2,493 in 1880, the daily sick 99 against 113, and the death-rate 48·02 against 49·65. The ratios for 1881 are certainly a slight improvement on those of the previous year, and it is very satisfactory to be able to report that the information which has been received thus far regarding the results of 1882 (up to October) show that the improvement, which commenced in 1881, has continued and become more decided.

Surgeon-Major James Reid, the senior medical officer, has quite recently submitted an interesting report on the causes of the sickness and mortality; and as his experience of the settlement dates back from 1872, the remarks which he makes have an additional value, on account of his intimate acquaintance with every phase of life in the island. His report brings the information up to the end of March 1882. After a careful analysis of the evidence as regards the suitability of the dietaries in force, and which are pronounced to be good, sufficient, and well adapted to keep prisoners in health, Dr. Reid thus discusses the causes which contribute most largely to the sickness and mortality of the settlement:—

“At the outset I may state that, in my opinion, these causes are in no way due to defective hygienic or sanitary arrangements. There is no question here of improper or insufficient dietary, of want of attention to conservancy, of impure drinking-water, or of deficient air, space, or ventilation. The causes may, in essence, be summed up in one word—they are ‘climatic.’ The great and permanent cause of sickness here is the malarial, unhealthy nature of the stations on which convicts are located; and so long as it is necessary to locate the bulk of the convicts on them, so long must there be, of necessity, death and sick-rates such as those we have at present. Of all causes of sickness here, this is the most important and far-reaching in influence.

“Ross Island is now almost the only station left us that is decidedly healthy, and on which fever is not endemic. Its death-rates (ranging from 8·0 per 1,000 in 1881–82 to 21·3 in 1878–79) may therefore be said to represent fairly what we might expect in the case of all convicts if they could be located in a similar way on healthy non-malarial stations. The excess of deaths, on the other hand, of all other stations over the Ross rates may be put down as due to the cause I have noted, *viz.*, ‘location on a malarial unhealthy station.’ This latter statement requires this qualification, however, that convicts living on Ross, though employed on hard enough labour and on exposed out-of-door labour for the most part, are not employed on certain forms of labour which men living on feverish stations have to perform—swamp-reclamation, brick-making, lime-burning, &c. The second cause of sickness here is exposure of prisoners on out-of-door labour to weather. The worst results as regards health are obtained when we have the three following conditions combined:—(a) exposure during the rainy season; (b) residence on a feverish station; (c) employment on swamp or jungle work, or forest work generally.

“As I have already stated, it is found absolutely necessary to employ certain gangs on exposed out-door work all through the rains. But, in addition, for years past convicts have been employed not only on such works, but also on swamp-reclamation works and forest work. Of all employments, jungle work, generally, and reclamation works prove the most unhealthy. The native convict, who, with bare, unprotected feet and legs, is employed in cutting down large trees, undergrowth or secondary jungle, putting together in the creeks rafts of timber or bamboos, rooting up stumps of trees, working in mangrove swamps up to his waist in black mud, is peculiarly liable to injuries while thus employed. In this way, the sickness quickly runs up from these employments; and as all wounds and injuries heal very slowly here, and have a tendency to spread and become gangrenous (especially during the rains), all such cases require a comparatively long residence in hospital. Also, it has been found necessary, for the same reason, to admit into hospital the most trifling cases of wounds and injuries; so apt are they if left untreated to spread and develop into large sores. The result of all the above influences acting for years on convicts has been to bring about this state of matters, that for all settlement work, of whatever kind—swamp and jungle work included—we may be said to have no really healthy men available in many numbers; that the great majority of prisoners are physically weak and unfit for very severe work, and therefore break down quickly under the strain and exposure inseparable from the rougher forms of out-of-door labour. Now, no measures, I submit, can *quickly* change a generally bad state of health like this, which it has taken years to produce, into a highly healthy one. But, with time and careful working of the prisoners on the lines which the causes of sickness above enumerated indicate as natural and proper, something may no doubt gradually be accomplished in raising convict health to a higher level than its present one. In the first place, and as a primary condition, a few healthy stations like Ross are required (a) to locate newly-arrived convicts from India on, and allow them to gain strength and get accustomed to the new climate and diet; (b) to permit of transfers, from time to time, of sick, weakly prisoners from

feverish stations to regain health. With this arrangement, selected *healthy* prisoners would always be available for jungle reclamation, and pioneer work generally, and such works, if prosecuted *only during the dry season*, would be deprived of much of their bad effects; while, as soon as the rains commenced, the prisoners employed on these works might be withdrawn to the more healthy stations, and employed there on suitable labour and *under cover if possible*."

With regard to the deterioration which may occur in the salubrity of a once healthy station by reclamation works in its vicinity, Dr. Reid cites the instance of Viper Island, and says that, unfortunately, of late the number of healthy stations in the Settlement has, at least for some time to come, actually been reduced, instead of increased, by the reclamation works which have been prosecuted.

"For years this island had been remarkably healthy and free from fever. But in the course of the present year (May 1881), a reclamation work of mangrove swamp was commenced on the adjacent mainland. Now the rains are generally well in here in May, and the actual rainfall during this month I find recorded as 18.47 inches. The result of this work appears from the statement in the margin. I have given the fever-admissions in all other hospitals for the sake of comparison, as there is every year a rise in the general sick-rates all over the Settlement during the rains. It is easy to see, on looking at the figures, that the increase in the Viper admissions is, out of all proportion, greater than that in all other hospitals, and that, moreover, this increase coincides with the progress of the reclamation works. The admissions for fever shoot up at once in May, when the first *bund* is started, and gradually falling in August, rise again in September with the commencement of the second bund. Not only the prisoners actually employed on these works suffered from fever, but in a more or less degree, all the population living on Viper Island close by—free-residents as well as convicts. That Viper Island may again, in course of time, become healthy, when this reclaimed land in its vicinity has been drained and planted over with cocoanut trees, is possible. But our experience hitherto with regard to such reclaimed lands does not lead us to take a very sanguine view. In the meantime we have lost in it one of our few healthy stations, and have had, in addition, a considerable increase to sickness to add to our returns for the year, *due to the prosecution of such works during the rains*.

"There is something, however," DR. REID continues, "to chronicle by way of gain on the other side. Aberdeen and South Point are two of our oldest mainland stations, yet for years they proved most unhealthy and feverish to all residents on them,—to officers, subordinates, sepoy, free police, and to convicts. In the spring of 1880, Colonel Cadell directed a committee to report on these stations, and devise, if possible, a remedy. The committee recommended that the two swamps close to these stations should no longer have their soil turned over year by year for rice-growing; that, instead of this, grass should be laid down permanently, cocoanut trees planted at proper intervals, and drainage carried out as efficiently as possible. The results of this change I give in the following figures (in the case of Aberdeen):—

Average daily sick per 1,000—Aberdeen.		
1878-79	9.6	Average 11.1 while rice was grown and before drainage and planting out of cocoanut trees.
1879-80	12.6	
1880-81	8.4	Average 7.0 after drainage and planting out of cocoanut trees."
1881-82	5.7	

Figures are given to illustrate the result of the change, as regards the station of Aberdeen, which show that, during the period that rice was grown, the average daily sick was about 11 per 1,000; whereas, during the two years which have elapsed since the drainage and other improvements, the average has been about seven. Dr. Reid, writing further in illustration of the evil results which follow disturbance of swampy soil, states—

"That the swamp soil is still as poisonous as ever, and, under *certain conditions*, as fatal to health, is, I think easy of proof. During the rains of the present year, a gang of convicts were employed at Aberdeen in clearing the open, swamp drains from grass, weeds, and other obstructions. Sickness of a severe type soon showed itself,—the prominent symptom being jaundice,—and, as I understand, no fewer than 11 deaths occurred directly traceable to this employment. No better example, I think, than this could be quoted to show of what a deadly malarial nature all works connected with swamps and turning over the soil during the rains are. If, by means similar to those adopted in the case of Aberdeen, we can ultimately increase the numbers of our healthy stations (now limited to Ross and Chatham), one great step will have been accomplished. But it must never be left out of sight that those very works to which we look *ultimately* for some permanent improvement in convict health are, *during their progress*, themselves powerful causes in the production of sickness, not only amongst the prisoners employed on them, but also upon those residing in their immediate neighbourhood."

Measures have already been sanctioned and put in hand with a view of improving the health of the convicts. Among these, one of the most important is the locating of new arrivals on a healthy island, and their gradual acclimatisation.

MONTHS.		Number of Fever Cases admitted.	
		All other Hospitals.	Viper Hospital.
January 1881	- - -	730	87
February "	- - -	599	72
March "	- - -	754	51
April "	- - -	726	45
May "	- - -	841	204*
June "	- - -	1,093	207
July "	- - -	1,189	234
August "	- - -	807	190
September "	- - -	871	247†
October "	- - -	957	217
November "	- - -	924	352†
December "	- - -	893	193

* Reclamation work commenced—first bund started.
† Second bund started. ‡ (Rainfall 15.27 inches.)

With the object of bringing into prominent notice any remarks as to defects in jail construction, diet, clothing, &c., or suggestions as to improvements, and as to the special causes of sickness and mortality which had been made by medical officers in charge of the several jails of the country, abstracts of the sanitary sheets of each jail were published, for the first time, in last year's Sanitary Report. A similar précis has been prepared of the sheets received in connexion with the year under review. In many instances they have been prepared in a very perfunctory manner, and will not bear serious examination. Nevertheless, as compared with those of previous years, improvement is manifest. Where considerable care has been bestowed in their preparation, the remarks made have been reproduced in greater detail. The strength, admission, and death-rates of each jail are likewise given for convenience of reference; but, as in last year's report, remarks regarding such disease-causes as malaria, climate, &c., have not been particularised.

General Population.

This section may be appropriately commenced with a short notice of the general census of British India which was taken on February the 17th of the year under review: a work which, as Mr. W. Chichele Plowden, the Census Commissioner, in his preliminary memorandum* remarks, may fairly claim to be the largest work of the kind undertaken in any country—the enumeration on one and the same day of a population of 252,000,000. It would appear that, in those Provinces and States where the people had been numbered previously, there has been an apparent increase in a population of 218,000,000 of 12,750,000, or 6·2 per cent. In some cases, however, it is believed that the increase is more apparent than real, owing to accidental inaccuracies in previous figures. It is satisfactory to note, Mr. Plowden writes, that where the recorded increase in the number of the people has been most conspicuous—British Burma, Assam, Berar, and Sind—there was ample room for the population to expand. The only parts of the country which show a decided decrease are Mysore—a decrease of 17 per cent.—and Madras—a decrease of 2·4 per cent.; results which are, without doubt, rightly ascribed to the famine of 1877. For convenience of reference, the summarised results of the census of 1881, as compared with the previous census, are reproduced in the following statement:—

PROVINCE.	POPULATION ACCORDING TO CENSUS OF 1881.	POPULATION ACCORDING TO PREVIOUS CENSUS.		
		Both sexes.	Both sexes.	Years of Census.
Bengal - - - - -	68,829,920	62,709,405	1871	+ 10
Assam - - - - -	4,815,157	4,056,054	1871	+ 19
Madras - - - - -	30,839,181	31,527,872	1871	- 2·4
Bombay - - - - -	13,978,488	14,038,359	1872	- 3
Ditto, Native States - - - - -	6,941,631	6,786,855	1872	+ 2·3
Ditto - - - - - TOTAL	20,920,119	20,825,214	—	+ 4
Sind - - - - -	2,404,934	2,192,415	1872	+ 10
North-Western Provinces (excluding Rampore and Native Garhwal) - - - - -	32,699,486	30,769,056	1872	+ 6
Oudh - - - - -	11,407,625	11,219,675	1868	+ 1·6
Punjab (British territory only) - - - - -	18,786,107	17,611,498	1868	+ 7
Central Provinces - - - - -	11,505,149	9,251,229	1872	+ 25
Berar - - - - -	2,670,982	2,231,565	1867	+ 20
British Burma - - - - -	3,607,646	2,747,148	1872	+ 35
Mysore - - - - -	4,186,399	5,055,412	1871	- 17
Coorg - - - - -	178,283	168,312	1871	+ 6
Ajmere - - - - -	453,075	426,268	1866	+ 6
Baroda - - - - -	2,154,469	2,000,225	1872	+ 8
Travancore - - - - -	2,401,158	2,308,891	1875	+ 4
Cochin - - - - -	600,278	601,114	1875	- 14
GRAND TOTAL OF 17 PROVINCES	218,559,918	205,771,353	—	—

* "Gazette of India," September 10, 1881.

Vital statistics.

During 1881 births were registered throughout all the provinces of India, with the exception of Lower Bengal and Assam. In Lower Bengal the system of limited registration has been in force for some years past; nevertheless there has been but little progress effected. Assam inherited the system of selected areas from Bengal, but, it is satisfactory to note, abandoned it to a large extent in 1881, and it is expected that the records of 1882 will embrace a complete set of birth statistics for the entire province. In all the principal provinces the birth-rates were higher than in the preceding year, and the variation between the minimum and maximum was also in many instances less. The excess of male over female births ranged from nearly 4 per cent. in Mysore to about 17 per cent. in the Punjab. In all the provinces the births recorded were in excess of the deaths, with the exception of Coorg and of the municipalities of Bengal.

As in 1880, the birth registration in Bengal Proper was restricted during the year under review to 46 municipal towns, and the average annual ratio was 25·51. In 20 places the ratio was below this average, ranging from 5·92 to 24·68. The death-rate of the province for the year under review was 20·96, which was made up of extremes varying from 7·98 to 42·04. This is the highest average recorded in the Lower Provinces since the commencement of the registration; nevertheless, compared with the statistics of other provinces, it would appear to be still much under the truth. The death-rate among males was 23·02, and among females 18·92; the mortality recorded in the rural circles was at the rate of 20·45 per 1,000, against 33·47 in the towns. According to monthly distribution, the deaths were most numerous in the last three months of the year. The compulsory Registration Act was in force in 112 towns during the year, but great laxity was displayed by the officers concerned in carrying out its provisions.

The registration of births throughout the combined North-West and Oudh Provinces was introduced for the first time in 1879, and the births recorded during that year yielded a ratio of 28·69 per 1,000. This result, attained in the first year of its introduction, was highly encouraging, and the results of the two succeeding years have, to a great extent, fulfilled the hopes which were entertained of further success. In 1880 the birth-rate equalled 32·55, and in 1881 40·34 per 1,000, calculated on the figures of the recent census, and to 41·65, calculated on the population figures of 1872. This improvement was also observable in the statistics of individual districts. Out of a total of 49 districts, only in Kumaon was the ratio below 20 per 1,000 (19·32); in 2 it was between 20 and 30 per 1,000, in 22 between 30 and 40; in 20 between 40 and 50; and in 4 above 50. This general improvement was to a great extent due to the new method of registration introduced during the year, under which every village watchman keeps a nominal register of births and deaths, the reality of which can easily be verified by any inspecting officer; as a matter of fact, many such registers were personally inspected by the Sanitary Commissioner, and in not a single instance was the entry found to be false. Taking the statistics of the province as a whole, the births exceeded the deaths by 8·55 per 1,000. Of the five districts which returned more deaths than births, the excess to an appreciable extent was only in the Terai, where fatal forms of fever were very prevalent during the year. The deaths recorded during the year amounted to 1,402,473, or an equivalent of 31·79 per 1,000. With the exception of the famine years of 1878 and 1879, this has been the highest death-rate recorded since 1870. The increase was apparently due to general improvement in registration, as shown by the statistics of individual districts. Among these the death-rate in 19 ranged between 20 and 30 per 1,000, in 28 between 30 and 40, and in two it was above 40. The highest mortality was in the Terai district, the next highest in Cawnpore, and the lowest in Dehra and Kumaon. With the exception of Partabgarh, the deaths among males in every district exceeded those among females, and the average excess for the province was at the rate of 13 per cent. The ratio of deaths in the rural circles was 31·39 against 37·80 in towns. Among the 100 towns in the province, the highest death-rate was at the town of Ajudhia in Fyzabad, where it equalled no less than 115·26 per 1,000, 81·68 being contributed by fevers alone.

Although 1881 was only the second year in which births were registered throughout the Punjab, the results obtained were highly satisfactory, and an examination of the detailed statements reveals marked progress in all the districts of the province. In 1880 the birth-rate was 31·15, but in 1881 the 695,766 births recorded in the province yielded a ratio of 39·79. In only two districts, Simla and Peshawar, were the birth-rates below 20 per 1,000, viz., 15·84 and 18·54 respectively. It is to be noted, however, that these figures are much in excess of what they were in the previous year. In five districts it varied between 20 and 30, in 10 between 30 and 40, and in 15 between 40 and 48. The births of boys exceeded those of the girls by 16 per cent.

against 21 in the preceding year. Excepting the four districts of Simla, Kangra, Amritsar, and Peshawar, the births were everywhere more numerous than the deaths. The results for the province, as a whole, indicated an excess of 10 per 1,000. In the year under report, 519,779 deaths were registered, against 472,731 in 1880, or an equivalent of 30 per 1,000. This excess was due to considerable increase in the deaths from cholera, fevers, bowel complaints, and other diseases not separately classified. In the rural circles the death-rate was 28 per 1,000, against 48 in the towns. According to monthly distribution the deaths were more numerous during the last four months of the year.

The results of birth registration in the Central Provinces during 1881 were much more satisfactory than in any year, from 1876 onwards. In the year under report, the lowest ratio, 37·91, was in the Burhanpur district; all the other districts returned a birth-rate of over 41 per 1,000 with a maximum of 59·39 in Murwara. The average for the province, as a whole, was 48·94. The statistics of the municipal towns, however, were not so satisfactory; still, compared with the figures of the year previous, they indicate some improvement, and it is expected that a strict enforcement of penalties, which the Chief Commissioner has now ordered in cases of breaches of the municipal bye-law regarding registration, will serve to ensure better results in future. The number of male to every 100 female births was exactly the same as in 1880, viz., 108; in all the districts the births were considerably in excess of the deaths, and the total births of the province exceeded the deaths by a ratio of 16·36 per 1,000. With few exceptions, the births were proportionately more numerous than the deaths in the towns also. In 1881 there was an abundance of food-grains in the province, and prices were generally low. But the death-rate for the year was 32·58, against 29·10 in 1880. This increase was probably due in part, at all events, to the improvement effected in registration, and in part to the somewhat unhealthy character of the year. There was a considerable rise in the mortality from cholera as compared with the preceding year, as also from fevers, bowel complaints, and "all other causes." In six districts the death-rate was under 30 per 1,000, the lowest being in the Burhanpur district, 26·58; in 12 it was between 30 and 40 per 1,000; and in two it was above 40 per 1,000, the highest, 43·93, being in Narsingpur. On the whole there were 116 male deaths for every 100 deaths among females. The total death-rate in towns was 40·65 per 1,000 of population against 32·02 in the rural circles.

The results of the recent census have disclosed that, during the interval between 1867 and 1881, there has been an increase of 20·3 per cent. in the population of the Province of Berar, raising the total number from 2,186,988 to 2,630,018. In comparing, therefore, the results of registration in 1881 with those of the preceding years, the fact should not be lost sight of that the ratios of the year under review have been calculated on the figures of the recent census. The aggregate of the male and female births recorded during the year was 104,921 against 91,105 in 1880, which again was the highest number attained since the commencement of the registration in 1871. But, for the reason already explained, the birth-rate of the year was nominally lower than that for 1880—39·9 against 41·7. Were the births calculated on the census of 1867, the ratio for 1881 would be 48·0. In all the districts the births were considerably more than the deaths, the average excess for the entire province being 10·7 per 1,000 of population. The figures for individual districts indicate that a decided improvement has been effected throughout the Hyderabad Assigned Districts. The local Sanitary Commissioner, however, considers that the figures recorded are still under the truth, and it is expected that the working of the revised registration rules will secure better results in future. As was noticed in the last annual report, the birth registration in towns was defective as compared with the results attained in the rural circles. Orders have, however, been issued to the district officers to rectify the defect. After the famine which prevailed in Berar during 1878, the total deaths in each of the two following years were between 51,000 and 52,000. In 1881 the number rose to 76,661, or to an equivalent of 29·1, against some 23 per 1,000 in the two preceding years. This increase of upwards of 24,000 deaths may, to some extent, have been due to improvement in registration as claimed by the Sanitary Commissioner of the province; but the increase was also, doubtless, due in part to epidemics of cholera and other diseases, the former having been almost wholly absent in the year previous. The variations in the ratios of individual districts was not so great, as is usually the case in other provinces—they ranged from 25 in Wun to 33 in Akola. The number of males who died to every 100 deaths of females was 114·6 against 119·6 in 1880. As in the case of births, the results of death registration in towns were also less satisfactory than in the rural circles, the total ratio for the year being 28·4 in the former, against 29·2 in the latter.

The census figures of 1881 were likewise adopted in British Burma as the basis for calculating the ratios of births and deaths. In attempting to compare the ratios of the past year with those of the years which preceded it, the results of 1881 are as elsewhere under similar conditions at some disadvantage; for according to the recent census, the population of British Burma has increased by 577,859 persons. The total number of births recorded was 73,754, a birth-rate of 19·98 per 1,000 of the population against 23·16 in 1880. The number of boys born to every 100 girls was 106 against 107 in 1880; and the excess of births over deaths, which was almost general throughout the province, was 4·23 per 1,000. The total deaths registered was 58,136, against 55,185 in the year previous, or a ratio of 15·75 against 17·72. The registration had greatly improved in many of the towns, but still in several of them the results left much to be desired. An average death-rate of 27·78 was recorded for the towns as a whole, and 14·22 for the rural circles. Although these results do not appear to be very satisfactory on the whole, compared with the statistics of other provinces, it is to be remembered that there are exceptional difficulties to be overcome in Burma, and there is evidence to show that the collection of vital statistics is improving year by year.

In 1880 the registration of births in Assam was restricted to eight towns. In 1881 it was introduced into six out of the eight districts of the Province. Of the other two districts, it is said that in Sylhet it will be commenced from 1st July 1882, and that in Cachar, although the registration of births has been in force for many years, by an oversight, these statistics have not hitherto been furnished nor embodied in the Sanitary Report of the Province. In Assam, also, the census figures of 1881 form the basis of calculating the ratios of vital statistics for the year under review; and this is an additional reason why comparisons between the statistics of 1881 and 1880 cannot be satisfactorily instituted. The birth-rate of the year, 19·25 per 1,000, exceeded the death-rate by 2·27. Great attention has been paid to the collection of vital statistics in this Province, and the Chief Commissioner, in his Resolution on the Sanitary Report, states that "compulsory registration has been extended to all municipalities, and to several other local areas. . . . Efforts have been made to secure a uniform system of reporting, and to arrange that no area may escape registration. . . . In parts of the Khasi and Jaintia and Garo Hills a tentative system of record is being started." Managers of tea gardens also have been directed to submit similar statistics as regards births and deaths occurring amongst their coolies. As in previous years, deaths were registered throughout the province, and the total number for the year was 71,941, against 51,666 in 1880. But, notwithstanding the marked improvement which has been effected in registration, the results are still far from satisfactory. The ratio of mortality for the entire province, 16·04, varied from 6·87 in Cachar to 23·71 in Nowgong; and the male deaths exceeded the female deaths by 21 per cent. Imperfect as these statistics certainly are, they are nearer the truth than those of the year previous, when the death-rate was only 13·61, and the number of male deaths to every 100 deaths of females was 136. The ratio of deaths in the towns was 23·46, and in the rural circles 15·95.

Notwithstanding that vital statistics have been collected during the last 13 years in the Madras Presidency, the results are more defective than those of several of the provinces of the Bengal Presidency. It is, however, satisfactory to find that the ratio of births recorded in 1881, 25·5 per 1,000, was higher than in any of the twelve preceding years, and that it stood at double the rate to which it was reduced in the year following that of the famine of 1877. The number of males born to every 100 girls was 105, or the same as in 1880. The excess of births over deaths was 9·3 per 1,000. In the report for 1880 it was noticed that the prices of food-grains were low as compared with previous years. In 1881 there was further reduction in the prices, but the general health was not so satisfactory as in the preceding year. The prevalence of cholera in the southern districts of the Presidency during the last three months of the year added largely to the mortality, and there was also some increase in the deaths from small-pox and injuries. The death-rate of the Presidency, in consequence, rose from 15·7 in 1880 to 16·2 in 1881. These ratios, however, can hardly be taken as representing the true mortality. In several of the provinces of Upper India the death-rate was almost double the ratio for 1881 in Madras. Tested by the results obtained in the Presidency towns, it would appear that the ratios of individual districts are still very defective. In four of the districts the number of deaths recorded under females was in excess of the deaths registered under males. In the rural circles the death-rate was 15·8, against 22·8 in the towns.

The total number of births registered in the Bombay Presidency during 1881 was 459,657, or 88,784 more than in the year previous, the figures of which were again in excess of those for any year since 1872. The male birth-rate was 14·58 per 1,000 of

population, the female birth-rate 13·35, and the ratio for both the sexes taken together 27·93. This ratio, although calculated on the census of 1881, which showed an increase of 225,640 to the population of the Presidency, is yet considerably higher than that attained in any of the preceding nine years. It is satisfactory to note that this improvement was very general throughout the Presidency. The proportion of excess of male over female births was also nearer the truth than in 1880. These results indicate the improvement that has been effected in the matter of registration since the amalgamation of the Vaccination with the Sanitary Department. With few exceptions, the births in all districts exceeded the deaths; and the average excess for the Presidency during the year amounted to 4·75. In many of the towns, however, including the city of Bombay, the results were not very satisfactory. The total number of deaths reported during the year was 381,450, or an equivalent of 23·18, according to the recent census. The male deaths exceeded the female deaths by 12·7 per cent., against 16·4 in 1880. The mortality was heaviest during the last five months of the year, the maximum number of deaths having been in August. The average death-rate of the towns was 29·07, and of the rural circles 22·32. The increase in the total number of deaths compared with 1880 was, possibly, in part due to improvements in registration, but it was, in the main, due to the prevalence of epidemic cholera from June to October.

Compared with 1880, there was some improvement in the registration of vital statistics in Mysore. The mean birth-rate of the province during 1881 was 23·70, against 17·27 in 1880. In nearly all the districts a larger number of boys was born than of girls. The births exceeded the deaths throughout the province, the total excess amounting to 6·68 per 1,000. The total death-rate of the year was 17·02, against 15·78 in 1880. The average death-rate of rural circles was 17·06, against 16·24 in towns. In Coorg the birth-rate was 15·86, against 11·95 in the year previous. The ratio of males born to every 100 females was 105·60 against 109·80. The results of death registration in this province, however, were not very satisfactory. In 1880 the ratio was 21·46, and in 1881 it fell to 17·90.

As mentioned in last year's report, the death registers of cantonments in the Bengal Presidency and Hyderabad Assigned Districts are now received direct by the local Sanitary Commissioners, who furnish a summary of the registers of their respective provinces to this office month by month. As in the preceding year, the lowest death-rate (3·36 per 1,000) in 1881 was among the natives at Fort William. The maximum mortality was at Auritsar, 93·82 per 1,000.

As mentioned in last year's report cholera was comparatively little prevalent over great part of India during 1880. In 1881, however, not only was the distribution of the disease more general, but its incidence in nearly all provinces was more severe; the aggregate number of deaths registered in British India rose from some 118,000 in 1880 to 161,000 in 1881, or an increase of about 43,000. As compared with 1879, however, the returns of 1881 show a diminution in the cholera deaths of considerably over 100,000.

PROVINCE.	Population.	DEATHS FROM CHOLERA.							
		1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Bengal*	59,878,497	56,876	109,988	196,590	155,305	95,192	136,363	39,643	79,180
Assam	4,483,705	16,478	6,618	8,615	11,377	6,732	17,415	2,803	5,010
North-Western Provinces and Oudh	44,107,869	6,464	64,427	48,311	31,770	22,221	35,892	71,546	25,865
Punjab	17,487,125	78	6,246	5,736	29	215	26,135	274	5,207
Central Provinces	7,409,865	14	14,643	20,124	3,418	40,985	27,575	330	9,140
Berar	2,630,018	2	22,465	2,688	842	34,306	223	1	3,404
Rajputana	†	†	1,203	283	60	2,398	918	—	197
Central India	†	†	2,555	1,929	926	8,047	2,734	299	581
Bombay	16,454,414	37	47,573	32,117	57,228	46,743	6,937	684	16,694
Hyderabad	†	†	10,891	5,582	7,414	6,696	6	—	1,721
Madras	28,676,375	313	94,547	148,189	357,430	47,167	13,296	613	9,446
Mysore	4,186,188	†	2,504	12,087	2,902	723	14	25	25
Coorg	178,302	†	†	210	†	49	—	—	3
British Burma	3,692,263	960	761	3,678	7,276	6,759	1,828	2,638	5,239

* Excluding Calcutta.

† Statistics not available.

‡ Population not known.

The above tabular statement shows that, whereas the mortality from cholera in Lower Bengal and in Assam during the year under review was about double what it was in 1880, in the Punjab the deaths rose from 274 to 5,207, in the Central Provinces from 330 to 9,140, in Madras from 613 to 9,446, and in Bombay from 684 to 16,694. The number of deaths in the North-Western Provinces and Oudh fell from 71,546 to 25,865; these combined provinces stand alone as showing a decrease during 1881, just as in the previous year they stood alone in showing exceptional prevalence.

In last year's annual report, when considering the exceptional immunity which large tracts of the Bengal Presidency had experienced during 1880, prominent attention was drawn to the history of coolie emigration during recent years, especially as regards the mortality which had occurred amongst coolies proceeding through Eastern Bengal to Assam. It had been maintained that the marked exemption from cholera amongst these emigrants during 1880 was solely due to improved arrangements which had been made in the water-supply of the steamers in which they were carried. But the variations in cholera mortality amongst the general population of the districts through which the coolies passed were just as marked, and even more marked, than amongst the emigrant coolies themselves. "The evidence," it was remarked, "so far as it yet goes, seems to prove" only that there has of late been a remarkable diminution in cholera over those parts of "the country which the emigrants traverse, and that from this the emigrants benefited in" common with the inhabitants of those parts." In the earlier part of the current year (1882), a striking illustration of the general correctness of this view was furnished by the experience of four steamers during their passage with coolies up the Brahmaputra, when 62 deaths from cholera were reported out of a total of 1,791 emigrants: one of the steamers—the "Nepal"—with 484 coolies, lost 40 emigrants from this cause during the month of March. The accommodation on board and all the arrangements were pronounced to be good, and the only explanation offered as to the probable cause of the outbreak was that the disease may have been imported at one of the embarking stations. It does not seem to have occurred to those who gave an opinion on the matter that some light might be thrown on it by ascertaining whether it had or had not prevailed at the same time in the districts through which the immigrants had passed. As a fact, the general population were at that time suffering much more than they had done for years. The statement in the margin gives the cholera deaths in all the districts of the Assam valley in February and March of the last three years, from which it is evident that in both these months of 1882 cholera was much more prevalent than it had been in either 1881 or 1880; and, what is of still more importance, that in Kamrup—the district through which the vessels were passing when the outbreak chiefly occurred—the number of deaths from cholera, which in February 1880 had been 40 and in 1881 only 10, rose in 1882 to 210. For March the figures are 46 for 1880, five for 1881, and 734 for 1882. It requires but very little reflection to see that the cause from which the coolies suffered, whatever it may have been, must have been widespread, and that any explanation of the outbreak which applies to the coolies only and leaves the people generally out of account could but have proved futile. Of the importance of providing a pure water supply there can be no two opinions, and, as was remarked in last year's report, it is to be hoped that the results of future years may show that the reforms introduced on board the Assam steamers have aided in reducing the mortality among the emigrants; but in such obscure and difficult questions as those which relate to cholera, hasty conclusions which deal with only one set of facts and exclude all others can only lead to error.

*Cholera in Assam during February and March
1880, 1881, 1882.*

DISTRICTS.	FEBRUARY.			MARCH.		
	1880.	1881.	1882.	1880.	1881.	1882.
Lakhimpur - -	1	0	5	0	0	1
Sibsagar - -	1	4	1	2	0	0
Nowgong - -	57	6	9	25	5	37
Darrang - -	1	0	23	2	0	37
Goalpara - -	7	0	30	7	0	5
Kamrup - -	40	10	210	46	5	734
Total - -	107	20	287	82	10	864

The practical lesson which the experience of these three years amongst coolie emigrants of the Assam valley inculcates is a very important one, though it is but one more added to the number of lessons so frequently taught in connexion with the management of troops and pilgrims. If men, and especially men wearied by travel, underfed or improperly fed, pass through a place in which cholera prevails, they are very liable to be attacked, and that in a larger proportion than the ordinary residents. When bodies of men have to pass through cholera-affected localities, they should do so rapidly—any attempt at quarantining them in such territory would be cruel, and would be analogous to detaining persons in a malarious swamp, lest they should disseminate the fever they had contracted in it in another part of the country.

In several instances, during the course of the year, attempts were made by local authorities to obtain sanction for the enforcement of quarantine, with the object of controlling cholera. For example, in September, the Commanding Officer introduced what were virtually quarantine restrictions into the Jullundur cantonment, with the object of protecting the residents from the disease during a period of its prevalence in the neighbouring town. As this procedure was not only a violation of the cholera regulations in force, but also at variance with the practice which has been found to be most

satisfactory all over the country, it was immediately countermanded by His Excellency the Commander-in-Chief: "No reasons," it was stated, "have been advanced in favour of relaxing this rule at Jullundur, which might not be applied to any other cantonment during a time of cholera prevalence; and, in view of the very strong opinion expressed by competent authorities, that no benefit can be derived from the enforcement of quarantine, and the strict orders that have from time to time been issued against its establishment," it was ordered that "all restrictive measures may, in the present instance, be limited to preventing the military as well as native establishment and followers from visiting any places in which cholera exists, all such places being, as far as practicable, put 'out of bounds.'" The quarantine restrictions were thus immediately withdrawn, and although the disease was very prevalent in the town and neighbourhood of Jullundur, the cantonment almost wholly escaped. Had the quarantine restrictions been sanctioned in this instance, it need hardly be said that the exemption of the cantonment would have been attributed to the action of the local authorities, and the case would have been cited as evidence of the value of quarantine as a protection against cholera.

Again, in April 1882, the Officer Commanding, Thayetmyo, having learnt that two cases of cholera had been imported into the station by one of the Irrawaddy steamers, suggested the introduction of various restrictive measures, regarding which the Chief Commissioner observed that they "amount to a proposal that quarantine should be established against all river steamers on which may be found 'any people suffering from serious disorders.'" The Chief Commissioner knows of no legal power to establish such quarantine on river craft. . . Such quarantine would, in the case of an epidemic probably do more harm than good. It would confine the passengers and crew in a small and possibly infected area. It might keep alive and intensify an epidemic. Unless they were kept on the steamer till all died, some of the passengers must eventually come on shore." Consequently, Mr. Bernard decided that he could not sanction the proposed quarantine "without much stronger grounds than have as yet been brought forward."

The experience of fairs and other gatherings in this country has, again and again, testified to the truth of the conclusion, that cholera is not carried by persons from one locality to another, so as to cause persons not themselves exposed to the necessary local influences to become affected by the disease. Coincidences certainly can be cited, in which the arrival of persons from a cholera-affected district has been closely followed by an outbreak of the disease; but even these coincidences are far fewer than is generally supposed. An illustration of such a coincidence is furnished by the history of the great fair—*Magh mēla*—which was held in January 1882 at Allahabad. On this occasion the *mēla* was of a special character—it was a *Kumbh mēla*, which recurs only every twelfth year, and was consequently very large. The fair lasted from the 5th of January (the first day of the month of *Magh*) to the 3rd of February; but the great bathing day was on the 19th January, when it is believed that nearly a million of people were congregated together at the confluence of the rivers Ganges and Jumna. These people had collected from all parts of India. Between the 16th and the 23rd January numerous cases of cholera occurred, among them 231 having proved fatal. The slight outburst of cholera which followed the fair, occurring as it did at an unusual time of the year, attracted some attention, and the general impression was that it had been caused by the dispersion of the pilgrims. But the facts will not bear such an interpretation. Allahabad is a central station, and lines of railway diverge from it in various directions; but it is worthy of special note that it was only in districts more or less closely located along the southern line of railway that cholera was reported during this period. In the district of Jubbulpore 97 persons were attacked between 21st of January and 5th February, the dates apparently of the first and last cases. For the most part it is believed that these cases occurred amongst persons who had been at the Allahabad *mēla*, which is only 12 hours by rail from Jubbulpore, and many of them had been taken out of the train affected with the disease. How many persons suffered, other than those who had been to the *mēla*, is not quite clear from the records; but this inquiry is of the less importance, as it is quite clear that the registers of nearly all the districts along this line of railway give indications of the presence of cholera in them, even before any case of the disease had been witnessed in Allahabad, and before the pilgrims could have dispersed. As considerable attention has been drawn to the cases of the disease which occurred at Jubbulpore and other places in this direction, as illustrating the possibility of the disease being spread from a given focus by human intercourse, a very careful examination of the statistics of the country within a radius of 200 miles from Allahabad during this period has been made, and a map was prepared showing the days

in January when the first cases occurred. This inquiry demonstrated that deaths from the disease were reported in villages at some distance from Jubbulpore, and away from the line of rail on the 2nd, 10th, and 11th of the month; that is to say, before any case had occurred at the Magh mēla; and on the 17th, deaths were reported in two districts, simultaneously, at a distance of from 30 to 40 miles from the railway at Jubbulpore. Moreover, the district of Damoh, which is much more inaccessible from Allahabad than any other district in these parts, suffered much more during January than any other; 329 deaths were registered in this district, against 35, for example, in the district of Jubbulpore. At Banda, some 60 miles to the west of Allahabad, and away from the line of rail, deaths were reported on the 8th January, and cases continued to occur during the whole month, though the first cases must have been wholly unconnected with the outbreak at the Magh mēla. When it is further considered that along the lines of rail proceeding in a north-westerly and in the opposite direction the districts suffered remarkably little from cholera, though many deaths amongst the pilgrims had occurred at various railway stations in these directions also, it becomes abundantly evident that the occurrence of the disease in the districts along, and for some distance beyond, the Jubbulpore railway about the same time that deaths amongst the pilgrims took place at the railway stations was merely a coincidence, and that even the force of the coincidence is materially diminished by the circumstance, above narrated, that the disease had been registered amongst the people of the district before any pilgrims could possibly have reached their homes. A careful scrutiny of the facts, which have thus been collected, fully bears out the statement of the Sanitary Commissioner of the North-Western Provinces and Oudh, who was present at the fair, that, though dying and dead persons were taken out of the train in all directions of the lines of railway, the "disease" only troubled the pilgrims who had been to Allahabad, and did not affect residents who "stayed at home;" and this assertion is further borne out by the Commissioner of the Allahabad Division, who in his report states that, though the deaths among the returning pilgrims were numerous, the epidemic did not spread, and the mortality ceased with the arrival of the pilgrims at their homes.

During the last two years the cholera statistics of European troops in India have been very favourable—a death-rate of 2·3 in 1881 against 2·8 in 1880, and 11·0 in 1879. Of the 137 deaths which were registered during 1881, 116 occurred in the Bengal Presidency, 80 of them being in the Punjab. As regards Native troops the results were also favourable, though the number of deaths was greater during the year under review than during the previous year. This matter has, however, already been referred to in the sections of the report devoted to the troops, and to these reference may be made for detailed information. As regards the history of cholera amongst prisoners reference should also be made to the section of the report which deals with them. But it may be stated here that there were 306 deaths from the disease among the jail population of the country, nearly 200 of which were returned by the jails of the Bengal Presidency, and that the mortality returns of the year were, under this heading, not so favourable as were those of 1880, but much more favourable than those of the years 1877 to 1879.

For several years past, special reports have been prepared of every cholera outbreak which has occurred amongst European and Native troops, and amongst prisoners, by the medical official in charge. A standard form is issued, with a series of questions printed on one side of the page, and blank spaces for replies on the other. The information thus collected has been summarised year by year, the replies from each presidency and from each section of the community being grouped under a few general headings, such as effects of fatigue and exposure in inducing the disease; the atmospheric phenomena observed during the outbreak; evidence of importation and of subsequent diffusion of the disease, &c.

As regards the probable influence of unusual fatigue, exposure to weather, or excess of any kind in inducing cholera, one medical officer writes of a case which occurred at Meerut: Had suffered much from ague last year and was reported to have been drinking rather hard for a few days previous to the attack. Another writes that the patient was attacked ten days after having been released from a 42-days' imprisonment; and a third, "During the previous 10 days had been confined in the guard-room, awaiting trial by court-martial for drunkenness." One of the men attacked at Meerut is reported to have eaten a quantity of green, unripe plums; he then went to the plunge bath and remained there some time, and said that he had felt cold and had rigours after coming out of the bath. The disease is frequently attributed to recent intemperance, and to irregular habits amongst European troops, though very frequently cases are cited in which nothing of the kind can be adduced. As regards Native troops

also, recent irregularities of various kinds are cited, as, for example, in the following instances: the man ate very heartily of meat and bread on the previous evening, and drank a considerable quantity of butter milk. It being the month of Ramzan, he had not eaten or drunk anything after sunrise of the day on which he was attacked. Another man was a bad character: On the day of attack had been drinking freely of the lowest kinds of liquor, and had eaten a large number of custard-apples. In the evening continued drinking and performing gymnastics on a tree (where he is said to have had a fall) along with a friend of his, who also had an attack of cholera later on. A third case had, on the morning of attack, been to the bazaar, and had returned tired; went to sleep in the verandah of his barrack, and was there exposed to cold and wet. As regards prisoners, exposure is occasionally cited as inducing causes; and, in one instance, the medical officer writes of a case which occurred in a man under sentence of death—"It is possible that the severe mental depression, consequent upon his capital sentence, may have served to develop the attack. Fear and other depressing nervous influences exercise a very appreciable effect in the causation of cholera." In the majority of outbreaks more or less marked evidence of premonitory diarrhœa was observed, though in not a few nothing of the kind was observed. One officer writes: "There were a few cases of diarrhœa which developed suspicious symptoms simulating those of cholera, with prostration and more or less marked collapse about the time when cholera cases were being admitted. In other instances cramps and vomiting accompanied the diarrhœa, but no suppression of urine." At Kamptee it is stated that the number of diarrhœa cases increased towards the end of the outbreak; whereas at Dinapore and several other places the cases were most numerous immediately before and during the outbreak.

Nor are any atmospheric phenomena referred to which are characteristic of seasons of cholera outbreaks. For the most part the air is described as close, damp, and sultry. The medical officer of the 2-22nd Regiment at Allahabad states that there was a heavy sandstorm, preceded by intense stillness of the air. The heat was great and the wind easterly. Somewhat similar phenomena were observed at Meerut. At Morar there was thunder and rain on the day in which the first European was attacked. At Meean Meer the weather is described as having been hot and cloudy; a sandstorm passed over the station during the period of outbreak, and there was also a little rain "followed by that peculiar and characteristic graveyard odour which is always noticeable at Meean Meer after early showers of rain in the hot weather." Other medical officers at this station describe the atmospheric phenomena of this period in a somewhat similar manner; and one, when referring to the occurrence of the disease at the adjoining fort of Lahore, writes: "There has been an unusual amount of rain this season, and the connection between it and the cholera cases appears to be distinct, the cholera appearing after the rain." At Amritsar a similar state of the weather was observed, "the rainfall previous to the outbreak was excessive." In other places, on the other hand, outbreaks are recorded which were not preceded by any rain, though in most instances atmospheric disturbances were observed. As regards the direction of the wind, nothing distinctive can be detected in the reports. One writer observes: "The course of the wind was erratic, but the prevailing wind was westerly, and the general course of the disease appeared to be against it." Writing of the cases which occurred in the Lahore central jail the medical officer observes: "The rainfall seemed to be attended with an increase of cases and prejudicially affected the sick—cases that seemed to be getting well suddenly got worse. Ultimately the disease suddenly ceased after a very heavy fall of rain attended with thunder and lightning. The wind, which had steadily been in the east, veered round and blew for about a week after the storm from the west."

In only very few instances is evidence seriously adduced in support of the view that the first case during an outbreak of the disease was imported from a previously affected locality, and that subsequent cases were due to personal communication with the first. But the possibility, or rather the probability, of such having been the case is frequently assumed. For example, a medical officer, speaking of the disease at Kamptee, writes: "No direct communication traced, but it is considered probable that there was indirect communication." Of the few instances of supposed direct communication with cholera-affected persons, and consequent infection, the following may be cited: The medical officer of the H-1st R.A., Jullundur, writes: "It is supposed that the infection was imported by the R.A. dooly-bearers, who slept in the verandah of the guard-room, under the window of the 'day room,' where the prisoner was confined." These statements, and many others of a similar kind might be cited, are in reality but

expressions of opinions, and cannot be accepted as evidence to be examined and weighed in the settlement of any question connected with cholera.

A tabular statement has been prepared (though not printed) of the replies which have been furnished to the questions: "The number of buildings occupied by men and families? The number of these which furnished cases?" An examination of the figures thus collected is instructive, as showing the great discrepancy which exists during different outbreaks, and at different places in a particular town during the same outbreak, as to the proportion of buildings attacked to the proportion which escaped. In some cases, when the aggregate number of occupied buildings was very small, all or nearly all were found to have furnished cases; in others the proportion of affected buildings was very small, under one per cent. In the statement above referred to, some 10,500 buildings, such as barracks, jails, asylums, &c., are enumerated as having come under review, and of these 335 furnished cases of cholera, or at the rate of about 3 per cent., a result which is not compatible with the general belief so readily accepted of late years that the disease is easily transmissible from person to person and from house to house.

For some years past records have been collected of the number of attendants on cholera patients who have themselves been attacked by the disease. The mere fact that a person who has been attending on a cholera patient has been attacked by cholera is not unfrequently recorded as a sufficient proof that the disease had been communicated from the sick to the healthy. Judging from such reports, it would seem to be expected that attendance on cholera sick should actually confer immunity from attack. The fact is wholly ignored that the sick are usually treated at or near the place where they were stricken with the disease, and that the attendants are subject to similar local influences. Owing to these and to the enervating effects of prolonged and constant attendance, the disease might be looked for more commonly amongst the attendants. But actual figures do not support this expectation. During 1881 records have been kept, as will be seen from the marginal table, of 861 cases of cholera which had been attended by 1,746 persons; but of this large number of attendants, only 36 were attacked, or at the rate of 2 per cent. This is by no means a high proportion of cases amongst persons living in a cholera-affected locality, nor is the proportion exceptionally low as compared with previous years.

The Number of Attendants on Cholera Patients attacked by the disease during 1881.

COMMUNITIES.	Number of Cases of Cholera.	Number of Attendants.	Number of Attendants attacked.
European troops - -	217	402	5
Native troops - -	167	725	14
Prisoners, &c. - -	477	619	17
TOTAL - -	861	1,746	36

On the contrary, as compared with 1880, it is considerably higher, and the ratio is nearly identical with that obtained from the figures which have been collected during the last five years—1877 to 1881—when, out of 7,859 attendants, 149 were attacked, or equal to 1.9 per cent. In the face of such statistical evidence as this it is not necessary to examine isolated instances in which the disease is supposed to have been contracted by attendance on the sick. It is the fact of dwelling in a locality where cholera-producing influences prevail which constitutes the danger, and not contact with an affected person.

Many replies have been furnished to the inquiry as to the existence of defects in drainage, water-supply, conservancy, accommodation, &c., but as, in most instances, the information has been given in the sanitary sheets, &c., already summarised in other sections of this report, it is not necessary to repeat here what has been more or less fully recorded already. A few of the more serious sanitary defects noted may, however, be referred to. As regards Dum-Dum, it is stated that there is no subsoil drainage; that the water is obtained from tanks; that the latrines are offensive; and that the guard-room in the first case had been for 24 hours previously in an unsuitable and badly ventilated building. At Meean Meer the surface drainage is reported to be defective; and it is said that, before the outbreak of cholera there, a branch of the canal was sometimes dry from imperfect and irregular flushing, so that offensive smells were emitted in close proximity to the barrack where the disease appeared. The water-supply of the Native troops at Bhagalpur is described as being not good, and similar reports are furnished as regards several other stations, but they do not call for special remark.

On the whole, the reports on the effect of movement of troops and prisoners from affected localities are exceedingly favourable. The medical officer of the Seaforth Highlanders at Lucknow writes: "Movement successful; general health of the men improved;" and regarding the effect of movement at Govindghur it is stated—

"Removal to camp Harupa had a very beneficial effect." As regards Meean Meer, it is stated that the first move was not successful, having been only a short distance from the barracks, but movements to a distance, along the line of rail towards Mooltan, were attended with complete cessation of the disease, which was all the more remarkable, because on two occasions when the troops returned to the cantonments, cholera appeared among them afresh, and disappeared again on their return to camp. At Kamptee, also, the first move was not successful. The prisoners of the Lahore central jail had to be moved on seven occasions. No cases of cholera were reported in connexion with the last three moves. It should be noted that the disease was very prevalent at Lahore and in other parts of the Punjab.

In connexion with this outbreak of cholera a special committee was appointed in September 1881. This committee, which consisted (as was stated in last year's annual report) of a President and of three members, the Sanitary Commissioner of the Province being the medical member, visited the various places embraced within the area of the epidemic almost immediately after it was convened; and a report is now being drawn up for submission to the Government, giving a detailed history of the disease as it occurred amongst the troops, prisoners, and the general population. It is to be regretted that so long a period should have elapsed before the results of the committee's deliberations are published; but the inconvenience of the delay will be far outweighed by the advantages which will result should the committee be able to recommend measures for dealing more effectually with future epidemics of this kind.

The history of cholera in India during the year under review would be incomplete without reference to the sudden outbreak at Aden during the month of August. This was the first appearance of cholera at this port since 1867, an interval of 14 years, and it is the first occasion on which an opinion has been advanced that the disease had been conveyed to this station by means of shipping from an Indian or any other port. The circumstances attending the outbreak are interesting from an epidemiological point of view. The sudden appearance of the disease had been ascribed to germs carried in a steamer along with bags of rice from Bombay. The question was thus eminently practical in its bearing on commerce, and the evidence was therefore very carefully examined by the Government of India immediately on receipt of the report of the special committee which had been convened to investigate the matter on the spot. The following extract from a memorandum, which was prepared for the Government; serves to show how wholly insufficient are the facts narrated by the committee to support the conclusion that the disease had been transported from Bombay. The whole case illustrates the readiness with which such explanations as to the causation of cholera are accepted in Europe—accepted in this instance before the special committee had submitted its report, and when, consequently nothing but the crudest information could have been available :—

The second point in these papers is the question whether the Aden cholera of August and September 1881 was or was not introduced by the S.S. "Columbian" from Bombay. In December last the Secretary of State observed that it was apparently admitted by the authorities at Aden that the outbreak at Aden was due to this ship. In Home Department letters, No. 10 of 21st January, and No. 26 of 31st idem, full particulars were called for on this subject, and the local authorities were asked for a categorical expression of opinion upon it, with a statement of the precise grounds on which their opinion was based. The information collected has now been submitted. There is the report of a special medical committee which assembled on the 28th October 1881; there is a separate memorandum on the committee's report by Deputy Surgeon-General Moore, who happened to be at Aden when the committee met; there are several letters from the Resident, and there is a

**Deaths from Cholera in the Month of July during each of the Years 1867 to 1881 in the City of Bombay.*

	Deaths.
July 1867	6
" 1868	3
" 1869	53
" 1870	2
" 1871	5
" 1872	46
" 1873	3
" 1874	2
" 1875	279
" 1876	119
" 1877	405
" 1878	156
" 1879	33
" 1880	1
" 1881	118

memorandum by the Secretary to the Government of Bombay, summarising the facts so far as they were ascertained. The Bombay Government express no opinion on the point, but the committee, Dr. Moore, and the Resident, all appear to have no doubt that the outbreak at Aden was due to the S.S. "Columbian." In endeavouring to form correct conclusions in this very important matter, it is essential to separate fact from theory. The committee are of opinion that some of the bags containing the rice cargo of the "Columbian" had been tainted by cholera discharges at Bombay, where cholera at the time was somewhat more* prevalent than usual; that in this way, the germs of cholera were conveyed to Aden, and affected certain coolies employed in unloading the vessel on the day of her arrival. The existence of a cholera germ, and the presence of this supposed germ in the discharges of a cholera patient, are hypotheses which, although accepted by many, can by no means be put forward as facts. But, in order that the Aden authorities

may have the strongest case possible, let it be assumed that these hypotheses represent facts and not mere theories; let it be assumed that cholera discharges really do contain cholera germs. The

evidence divided between theory and fact will then stand thus. The *theory* is that one or more of the rice bags of the "Columbian" were tainted by cholera discharges at Bombay; that the germs of cholera were thus carried to Aden, and that these germs fastened on certain coolies who were employed in unloading the ship, and who were in consequence attacked by the disease. This is the theory; but the actual *facts* adduced are that the "Columbian" left Bombay when cholera was somewhat prevalent, and that a fortnight afterwards certain coolies out of those employed in unloading her at Aden were seized with cholera. These coolies were, so far as is known, the first persons attacked in the settlement. They had been employed in unloading the cargo of the "Columbian" immediately previous; therefore the unloading of the cargo was the cause of their being attacked. There is absolutely no other evidence in favour of the conclusion, except the coincidence in point of time, but there are many facts to show that to all appearance the coincidence was altogether one of time, and that the events do not stand to one another in the relation of cause and effect. Such is the opinion I formed after a careful perusal of the papers, but, in order that the matter might be looked at from independent points of view, I asked Dr. Lewis to read them over, and to let me know what he thought of them. This he has done, and his opinion is given in the Memorandum appended.* With all he has said I entirely agree. I have very little to add to it, but I may state very shortly why I do not agree in the conclusion that the outbreak of cholera at Aden in August to October last was due to the S.S. "Columbian."

1st.—Before even the vessel arrived, there was unusual sickness and mortality at Aden. True there was no cholera, and the unusual sickness and mortality were confined to a certain section of the community,—a number of starving Somalis, who had come from the African coast. It is worthy of notice, however, that the class of people among whom the largest number of cases of cholera afterwards occurred was also the Somalis. Of a total of 185 attacks in the whole settlement, 135 were among Somalis. The number of the population of each class is not given, and so it cannot be said in what proportion the different classes suffered: but there can be no question that the Somalis suffered severely, and that they had begun to suffer in a very unusual degree from sickness of one sort or other long before the "Columbian" arrived. The two facts are of importance.

2nd.—If it had been shown that unloading the "Columbian" was the only one condition common to the persons first attacked, a strong case would have been made out in favour of the committee's view. But it is not so, for the coolies first attacked all lived in the same quarter, and some of those living there, who were attacked in the early days of the outbreak, had not been on the "Columbian" at all.

3rd.—There were, thus, at least two conditions common to the persons first attacked. The one was that they had been on board the "Columbian," and the other that they all resided at Steamer Point. Which of these conditions was most likely to have produced the disease? Certainly not having been on the "Columbian," for there was no such sickness on board that ship—there had been none previously; there was none at the time, and there was none afterwards. Much more probable it is that Steamer Point was the locality to blame. Here, as already pointed out, other cases of cholera followed among persons who had not been on the "Columbian." Moreover, the coolies first attacked were attacked so immediately after having been on the "Columbian," that the attacks seem hardly explicable on the "Columbian" theory. By the night of the very day she arrived one was dead. It seems also quite open to question whether this man, who formed the first fatal case in the settlement, had ever been on board the "Columbian" at all. The facts regarding him seem never to have been fully investigated, and he does not appear in the tabular statement of cases appended to the committee's report. All the information given concerning him is given in the following passage of the committee's report: "As it was reported that another coolie who had been employed 'on board the S.S. 'Columbian' had died during the night, inquiries were at once instituted," &c. This fatal case should have been inquired into with the greatest care, and every detail regarding it most fully stated. Moreover, if the germs from the rice-bag or bags were so potent as to cause the death of at least one man within a few hours, how was it that, among some 700 people who lived continuously on board her for weeks, not a single person suffered from them? Much more probable it is then, that the cholera-producing causes were in Steamer Point, and not in the "Columbian."

4th.—Further, there is not the smallest evidence that the cases supposed to have been due to the "Columbian" formed the centre from which others arose. On this point the evidence is not so full as was desired; but two instances are mentioned, in which attacks are attributed to contagion. Three children of the hospital dresser were attacked, and the cases of the two last seized were attributed to their having been in company with the child first attacked. Without figures to show how many persons were attacked, out of those who attended or came otherwise in contact with the sick it is not possible to form any opinion in this case. If the attendants suffered more than other people, the result is altogether different from what has been experienced in India, where statistics collected now for some years conclusively show that attendants incur no greater risk than other people. The only other instance adduced of supposed communication from the sick to the healthy is contained in the Resident's letter dated 9th December. He says, "A man on his way from Aden to the interior was seized at Imad with cholera, and on being taken into the mosque expired there: that night nine persons died." Such instances at first sight have a terrible dread attached to them, and it is no wonder that the ignorant people among whom they occur are filled with alarm, and, in this state of alarm, conclude that the traveller was, beyond all doubt, the cause of the calamity which befell them. But a moment's reflection will show that the story carries its own refutation. It is beyond all the bounds of reason to believe that deaths from cholera could be caused within a few hours by a traveller who himself died of the disease about the very same time.

* *Vide* Appendix A. to this report.

5.—And lastly, is the conclusion of the committee in accordance with the experience of Aden? For many years the traffic with Bombay has been constant and enormous. There has been every facility for the carriage of germs and the development of cholera in the place, if cholera be due to such germs; but so far from having suffered often from cholera, Aden has been specially exempt, more exempt than almost any place that can be named in Europe or Asia, and yet Aden is but a few days' sail from Bombay. Experience, therefore, does not accord with the committee's views.

The remarkable reduction in the mortality from small-pox, in the country as a whole, Small-pox. which was specially referred to in last year's report, is also manifest in the returns for 1881. There was some increase in Bengal, Assam, and in the North-Western Provinces and Oudh, as also in Mysore and Coorg. In Madras the ratio was the same as in the previous year, but in the Punjab, the Central Provinces, British Burma, and Bombay the death-rate from this cause was much lower than in 1880. As usual most of the deaths were among children under 12 years of age, and occurred during the first half of the year.

The death-rate from fevers during the year under review has everywhere been higher Fevers. than it was during 1880, with the exceptions only of the Madras Presidency and British Burma. This increase was in part due to the disease in its various forms being more general over the country, and also in part to epidemics of exceptional severity, which were attended by immense loss of life in certain districts, such as in Nuddea in Bengal, the Terai districts of the North-Western Provinces, Amritsar in the Punjab, &c. In Burma and Madras the mortality was heavy during the first two months of the year, but in all the other provinces the deaths from fevers were most numerous during the last quarter. In all the provinces the bulk of the recorded mortality was attributed to fevers, but it is very certain that many deaths from unascertained causes are put down under this head. As regards the terrible mortality from fever in the Nuddea district, a Commission was, in November 1881, appointed by the Lieutenant-Governor of Bengal, as it seemed that the presence of malarial fever in severe epidemic form for two seasons in succession pointed to some local cause distinct from climatic influence, and Rs. 50,000 were placed at the disposal of the Commission to meet the cost of making such improvements as might be considered absolutely necessary. The Commission has reported that in some localities to the south of the district which suffered in 1880, the disease had subsided in 1881, though the subsidence of the fever "was not preceded or accompanied by local alterations." The disease had, however, extended northwards and westwards, and it is estimated that during the year over 70,000 persons died of it. As regards the causation of the fever, the Commission is unable to offer any explanation. "We have," they say, "dwelt at length on the various insanitary conditions found in the villages, and have no doubt as to their very injurious action upon the general health of the people. How far they have caused, or even influenced, this outbreak of fever is more a matter of medical science, than one to be decided by a mixed Commission." Amongst some of the prominent insanitary conditions referred to, is the pollution of the water-supply in various ways, and notably by the bodies of the dead which are thrown into the rivers instead of being burned. Owing to scarcity of fuel in the district, cremation is beyond the means of the poorer portion of the population. As regards the frequently expressed opinion that the fever has been caused by embankments, &c., interfering with the natural drainage of the district, the Commission observe:—"In our opinion the outbreak of fever cannot be attributed to local obstruction to drainage from want of water-way in roads or railways, nor can it be shown that the silting up of old channels has been the immediate cause."

During the latter part of August, and during the months of September and October of the year under review, the inhabitants of the town of Amritsar in the Punjab suffered to a deplorable extent from a very fatal form of fever. It is estimated that, between the middle of August and the end of October, nearly 7,000 deaths occurred from the disease amongst a population of 149,000; that is to say, a mortality of about 47 per 1,000. It would appear that, although the population is composed of Hindus and Mahomedans in nearly equal proportion, the deaths amongst Mahomedans were not far from being twice as numerous as the deaths amongst Hindus. The Deputy Sanitary Commissioner, Dr. Bennett, who investigated the disease at the time, suggests that an explanation of this discrepancy in the death-rate of the two classes may be found in the fact that a large proportion of the Mahomedan population of the town was made up of poor, ill-fed, and badly-clad Kashmiris, among whom the disease was heaviest and committed its greatest ravages. It would appear that children suffered to an appalling extent. "It would probably be no exaggeration to say," Dr. Bennett writes, "that two-thirds of the infantile population have died since the commencement of the outbreak, and that

" the health of the remaining third have been so shattered that comparatively few, " among the poorer classes especially, are likely to survive beyond their fifth year." The sickness was, however, so universal, that it would appear that not a single European or Native escaped an attack. Nine-tenths of the shops are said to have been closed, and the work of Government offices was carried on with the utmost difficulty. To add to the general distress, cholera was likewise very prevalent amongst the people. Dr. Bennett states that two forms of fever were met with,—the ordinary intermittent and the rarer, but more dangerous, remittent form; but between these two extremes were many gradations, partaking of characters common to both. In its summary of the reports which had been furnished regarding the outbreak, the Government of the Punjab remarks that the mortality appears to have been mostly due to the saturation of the soil, resulting from unprecedented rainfall in a locality where the drainage was deficient, and where the system of conservancy was by no means perfect; and it has already issued orders that action may be taken to remedy these defects, so far as practicable, with the least possible delay.

Bowel
complaints.

The mortality from bowel complaints during 1881 does not call for special remark.

Vaccination.

It was observed in last year's annual report that, with the exception of the Punjab, the amalgamation of the Vaccination with the Sanitary Department had been carried out, and that the reports on the vaccine operations of all the other provinces for 1880-81 recorded the results of the working of the department under the local Sanitary Commissioners. In October 1881 this arrangement was also adopted in the Punjab, so that the amalgamation of the two departments is now completed throughout the whole of British India. The present staff of vaccinators is being gradually instructed in the elements of sanitary science, and in some provinces a good deal of useful sanitary work has already been done by this establishment.

That the work of vaccination has not suffered under the new arrangements is evidenced by the immense increase in the number of operations performed throughout India, which will be manifest by a glance at the statistics of the year under report and the preceding year. This increase was not confined to any one province, but was manifested all over the country, except in Lower Bengal and Madras, where owing to adverse circumstances, there was a marked diminution in the number of vaccine operations. Omitting Mysore, the report for which province has not yet been received, the total number of operations in India rose from 4,181,722 in 1880-81 to 4,571,166 in 1881-82, and the ratios of success in most of the provinces were also in excess of those for the year previous. This will be specially referred to when reviewing the results of the working of the department in the individual provinces.

During 1881-82 the operations of the Vaccination Establishment were extended, for the first time, to seven Police Circles in Purneah, two in Maldah, three in Bhagalpur, five in Mymensingh, and to some outposts in Pooree. Besides these, six Police Circles of Purneah, a sub-division of Darjeeling, and the entire Sonthal Pergunnahs District were made over to the licensed vaccinators. The total number of operations for the year was only 1,349,607, against 1,394,312 in 1880-81. There was a considerable decrease in the number of vaccinations performed in the Metropolitan Circles, and in the Darjeeling, the Eastern Bengal and the Orissa Circles. This falling off is attributed to the paucity of unprotected subjects in certain areas which had been repeatedly gone over by the vaccinators in previous years, to great sickness among vaccinators in some circles, to the opposition of the natives to vaccination, and to other causes. The operations performed by the paid and licensed vaccinators in the different circles of the province amounted to 1,284,925. Of these 1,275,667 were primary vaccinations, with 1,258,576 successful cases, and 9,258 were re-vaccinations, with 3,695 successful cases. The percentages of success in primary and re-vaccinations were, respectively, 98·66 and 39·91. The average number operated on by each vaccinator was 1,229, against 1,256 in 1880-81. The number of successful operations among children between one and six years of age was 831,881. Besides these, 64,682 operations were performed by the vaccinators attached to the municipalities, dispensaries, &c. Of these 61,964 were primary cases, with the ratio of success at 92·99, and 2,718 were re-vaccinations, with the ratio of success at 54·59 per cent. The aggregate of the successful primary and re-vaccinations performed by the various establishments in the province was 1,321,377. Altogether, 773,331 operations were performed by the licensed vaccinators, against 803,545 in 1880-81. The total cost of the establishment was Rs. 1,17,118-12, and the average cost

of each successful case rose from Rs. 0-1-3 in 1880-81 to Rs. 0-1-6 in the year under report. In all 21,929 villages were inspected by the superintendents, deputy-superintendents and superintending vaccinators. The Compulsory Vaccination Act was in force in the towns of Calcutta, Rungpore, Rampore Beaulah, Soory, Hooghly and Chinsurah, Pubna and Bogra. The Local Government has sanctioned, as an experimental measure, the expenditure of Rs. 1,500 per annum to meet the cost of animal vaccination in Bengal, with a view to secure an efficient supply of animal lymph at the beginning of every vaccine season.

There are no dispensary vaccinations in the North-Western Provinces and Oudh, and the working of the special establishment was, apparently, restricted to children under six years of age. The total number of operations performed was 767,259, against 729,185 in 1880-81. This increase was due to the work being carried out on a larger scale in 28 out of 51 districts. In the other 23 districts the number of vaccinations was less than in the previous year, the decrease in some being very marked, as in Bareilly, Kumaon, Gonda and Ghazipur. The diminution in Kumaon, especially, where such satisfactory progress had been made in this direction, is greatly to be regretted; but it is stated by the Sanitary Commissioner that particular attention will be paid to vaccination in the Kumaon Hills during the current year. The number operated on by each vaccinator was 1,256 against 1,219 in the preceding year. Out of the total number of operations, 745,925 were primary and 21,334 were re-vaccinations. Of the former 684,026 were successful, the largest number ever attained since 1870, and of the latter only 3,890 cases. In primary cases the percentage of success rose from 90·57 in 1880-81 to 91·70 in 1881-82, and in re-vaccinations the ratio of success fell from 23·46 to 18·23. In all 15·59 per 1,000 of population were protected by vaccination during the year. During the year two additional native superintendents were added to the establishment, and the average number of vaccinators employed rose from 598 to 610. But there was a great reduction in the cost of the establishment, which fell from Rs. 1,29,319 in 1880-81 to Rs. 1,14,452 in 1881-82, and of this amount only Rs. 93,753 was paid by Government. The average cost of each successful case fell from Rs. 0-3-2 in 1880-81 to Rs. 0-2-8 in 1881-82.

The Vaccination section of the Punjab Sanitary Report for 1881 refers only to the last nine months of the year, broken up into two distinct periods—the first embracing six months from April to September, during which the department was conducted under the old arrangements, and the second dealing with the last three months of the year when the new arrangements were brought into force. But with a view to preserve uniformity, and to secure facility of comparison with the statistics of previous years, the principal figures (showing the results of the working of the department in the entire province under the old as well as under the new arrangement) have been specially obtained from the local Sanitary Commissioner, and have been incorporated in the first six tables appended to this section. From these it would appear that the total number of operations performed by all the establishments throughout the province was 673,487 against 450,779 in 1880-81, which again was the highest number ever attained since the commencement of vaccination in the province. Out of these 663,294 were performed by the special establishment with 614,059 successful cases, and 10,193 by the dispensary establishment with 8,803 successful cases. The percentage of success in the operations performed by the special establishment was 95·0 in primary cases and 52·6 in re-vaccinations; and in the dispensary operations it was at the rate of 86·6 and 82·3 respectively. The average number vaccinated by each vaccinator was 2,034 against 2,618 in the year previous. The ratio of successful vaccinations per 1,000 of population was 35·62 against 21·41; and the percentage of estimated children born in the province, who were successfully vaccinated during 1881-82, was 55·9 against 43·0 in 1880-81. No information is available regarding the expenditure of the department during the year under report. By the new arrangements considerable additions have been made to the number of native superintendents and vaccinators, and it is expected that the working of the department in future years will show a marked improvement over the results hitherto obtained.

In the Central Provinces, also, there was a considerable increase in the amount of work done by the vaccination staff as compared with previous years. The total number of operations performed by the special establishment was 369,651, of which 361,310 were primary and 8,341 re-vaccinations. Of the primary vaccinations 152,554 were successful among children under one year; 161,696 among children over one and under six years; and 33,120 among persons of six years of age and upwards. The percentage of success amongst these was 96·14. Of the re-vaccinations 5,640 were successful, or at the rate of 67·61 per cent. The number of vaccinations carried on by the dispensary

establishment amounted to 27,131, of which 24,288 were successful in primary cases and 820 in re-vaccinations. The total number of operations performed by the special and dispensary establishments combined equalled 396,782 against 325,021 in 1880-81. Of these 378,118 cases proved successful, or a percentage of 95·2. The average number vaccinated by each vaccinator was 1,824 against 1,538 in the preceding year. During 1881-82, 47·64 per 1,000 of the population were successfully vaccinated, or 9·19 more than in 1880-81; and, estimating the annual births of these provinces at 40 per 1,000, the percentage of infants vaccinated in the first year of their birth was 56·6 against 49·66 in the year previous. The total cost of the establishment was Rs. 39,102, and the average cost of each successful case was Rs. 0-1-9½ against Rs. 0-2-1½ in 1880-81. It is satisfactory to find that the opposition of the people to vaccination in these provinces is becoming less year by year. A special class was opened in the Nagpur Medical School for imparting instruction in the elements of hygiene to the vaccinators, and some progress was made during the year in this respect. A considerable amount of sanitary inspection work was also done by the vaccinators.

There were no changes of any importance in the vaccination establishment of the province of Berar during 1881-82. The work was carried on by means of animal lymph, supplies of which were received from Bombay, and also raised locally by the superintendents in each district. The attitude of the people in this province towards vaccination continues unfavourable, nevertheless there was a considerable increase in the number of operations performed during the year. These amounted to 95,420, or 9,621 more operations than in the year previous; and the total number of successful cases was 85,654 against 74,371 in 1880-81. Of the successful operations 50,357 were among infants under one year of age, and 33,693 among children of above one and under six years. The average number vaccinated by each vaccinator was 1,670 against 1,358 in the preceding year. In the operations performed by the special establishment, the percentage of success was at 89·8 in primary and at 63·0 in re-vaccinations. The ratio of successful vaccinations in the province per 1,000 of population was 30·8; and estimating the births of the year at 40 per 1,000, the ratio of those who were successfully vaccinated during the year was 47·8 per cent. Although there was some increase in the total expenditure of the year, the average cost of each successful case fell from Rs. 0-3-9 in 1880-81 to Rs. 0-3-5 in 1881-82. In this province also some useful work was done by the native superintendents of vaccination in the way of sanitary inspection of villages.

The Burmans have a great dislike to vaccination, and the defective nature of a portion of the lymph supplied in 1881, which proved an entire failure, will, it is feared, tend to check the progress of vaccination amongst them. Notwithstanding these drawbacks, it is satisfactory to find that the total number of operations performed in 1881-82 was 51,085 with 41,488 successful cases, against 46,912 with 35,296 successful cases in 1880-81. Excluding from this total 408 operations which were performed by medical subordinates attached to dispensaries, there were 48,142 primary and 2,535 re-vaccinations, with 82·85 and 50·25 percentages of success, respectively. This work was carried out by 48 vaccinators, under the supervision of 16 civil medical officers, who were also superintendents of vaccination circles, at a cost of Rs. 21,084, nearly one-third of which was defrayed by the Local Fund Committees and the Municipalities. The average cost of each successful case was Rs. 0-3-5, or 9 pie in excess of the cost per head in the year previous. The average number of persons vaccinated by each vaccinator was 1,056, which was made up of extremes varying from 382 at Akyab, where the people are stated to be extremely averse to vaccination, and where work had to be suspended for a part of the year for want of lymph, to 3,537 at Kyoukpyoo. It was only in six out of the 16 districts that the average number was above 1,000. The number of persons successfully protected by vaccination during the year under report was only 11 per 1,000. The number of successful operations among children under one year was 7,310, which is not even one-twentieth of the estimated births of the year.

The Vaccination Establishment in Assam has not yet been placed on a similar footing to that of the other provinces of the country. The imperfect means of communication in the province, the sparseness of the population in most of the rural circles, and the prejudices of the people are very serious obstacles to vaccination being generally adopted for some time to come. Notwithstanding these exceptional difficulties, the local authorities are doing all in their power to further its progress, and the Chief Commissioner has declared his readiness to grant funds, if assured that the additional expenditure would produce an adequate return in more and better work being done. Omitting 5,102 vaccinations performed by private practitioners in tea-gardens, the total number of operations carried on by the civil surgeons, hospital assistants, vaccinators, and

ex-inoculators amounted to 40,309, against 24,179 in 1880-81. Of these 39,128 were primary operations with 34,698 successful cases, and 1,181 were re-vaccinations with 1,118 successful cases. The percentages of success were respectively 88·67 and 94·66. In connexion with the large increase in the number of vaccinations, it should be noted that in 1881-82 the number of vaccinators employed was 36, and of ex-inoculators 96 against 17 and 58, respectively, in the previous year: 5,048 operations were verified personally by the civil surgeons during the year, and the proportion of success among these as ascertained by them was at the rate of 87·20 per cent.; 3·3 per cent. of the estimated births of the year were protected in 1881-82, against 2·8 in the year previous. Steps have lately been taken to check the work of the ex-inoculators.

The total number of operations performed in the Madras Presidency was 601,222 against 659,759 in 1880. Of these, 590,875 were vaccinated by the special establishment entertained for the purpose, and 10,347 by the medical subordinates attached to the dispensaries. Out of the former, 580,791 were primary cases, of which 529,959, or 91·2 per cent., were successful, and 10,084 were re-vaccinations, of which 6,640 or 65·8 were successful; and out of the latter, 9,890 were operated on for the first time, and 457 were re-vaccinations, yielding a percentage of 82·84 and 47·70 successful cases, respectively. The total number of successful operations among children under one year was 98,292 out of an aggregate of 731,866 births registered during the year, and among children above one year and under six years was 260,565. The average number of operations performed by each vaccinator during 1881 was 790, against 912 in the year previous, and the ratio of persons successfully vaccinated per 1,000 of population was 16·7, against 18 in 1880. In primary cases, a success of 92·6 per cent. is claimed by the rural circles and districts, but this high proportion seems open to suspicion when compared with the proportion attained in the municipalities, where the work is carried on under more efficient supervision. The results of 1881 show a marked falling off under several heads; but it would appear from the local report that this was mainly due to the backwardness of vaccination in the districts. In the municipal towns there was a marked improvement in 1881. The large decrease of 58,537 in 1881 is attributed to a great falling off in the number of vaccinations in the Tanjore district, where, as compared with 1880, the operations were less by 118,013. The history of vaccination in this collectorate for the past two years illustrates very forcibly to what extent success or failure may depend on the district officers. In 1880, the Collector, Mr. Webster, took active measures to improve vaccination, and he succeeded in increasing the number of operations by about 105,000. In 1881 his services were, by his transfer elsewhere, lost to the district, and the total number of vaccinations decreased by over 118,000; or, in other words, the number in 1881 dwindled down to 56,711, from 174,724 in 1880, and 67,254 in 1879. The explanation that there was a paucity of subjects in Tanjore in 1881, an immense number of children having been protected during the preceding year, is hardly sufficient, inasmuch as the total number of registered births in this district during the year was 59,770, whereas the number of infants successfully vaccinated was only 6,712.

The total outlay on the special establishment in the Presidency amounted to Rs. 1,56,655-15-10, and it is satisfactory to notice that out of this only Rs. 17,909-7-0 was contributed by the Government, the remainder being defrayed by Local Funds, Municipalities, and Native States. The average cost of each successful case was somewhat higher than in the preceding year, being Rs. 0-4-9 against Rs. 0-4-4 in 1880. Although the general results of the working of the department during the past year are not so satisfactory as could be desired, it must be borne in mind that in Madras the whole work is carried out by only one Deputy Sanitary Commissioner, assisted by a few native deputy inspectors of not very superior qualifications; whereas in Bombay and in the different provinces of the Bengal Presidency there are several European officers, and native officers of higher status, to personally direct and supervise the work in their respective circles.

Excluding secondary operations, the total number of vaccinations performed among the general population of the Bombay Presidency by the special establishment and by the medical subordinates attached to dispensaries was 778,737 with 739,235 successful cases against 695,237 with 655,115 successful cases in 1880-81. Out of this aggregate 749,429 were performed by the vaccine establishment with 675,260 successful primary operations and 37,215 successful re-vaccinations, and 29,308 by dispensary establishments, of which 25,050 were successful in primary cases and 1,710 in re-vaccinations. The percentage of success attained by the special establishment was 96·73 in primary and 72·52 in re-vaccinations, against 96·16 and 73·83, respectively in 1880-81; and the ratio of persons successfully vaccinated per 1,000 of population was 27·88, against

25·25 in the previous year. The average number operated on by each vaccinator was 1,751, against 1,569 in the preceding year. Only 460,623 infants were protected, which is less than one-half of the estimated total births of the year. The deaths from small-pox in this Presidency were very few compared with the two preceding years, and were restricted almost entirely to the two divisions of Sind and Konkan. It appears from the Vaccination Returns that, in the former, out of a total population of 2,542,976, only 112,795 were successfully vaccinated during the year, and in the Konkan only 76,637 out of a population of over three millions. The number of vaccinators employed in this Presidency was 428, or one more than in the preceding year, and the total cost of the establishment was Rs. 2,60,356. Out of this, the contribution by Government amounted to Rs. 1,13,995, or Rs. 19,120 in excess of the sum paid in 1880-81. The average cost of each successful case was Rs. 0-5-10, against six annas in the year previous. Vaccination was carried out throughout the Presidency from arm-to-arm, and with human lymph, except in the town of Bombay, where only animal lymph was kept up, and at Poona, where both animal and human lymph were in use. Animal vaccination was discontinued in Kurrachee, owing to the opposition offered by the Hindu community. The results of the operations carried on with the English lymph received during the year were not very satisfactory. In Bombay 434 heifers were inoculated, with unsuccessful results in 34 instances, and in Poona 35 out of 39 heifers were successfully inoculated. In Kurrachee the Vaccination Act (No. IV. of 1879) was in force throughout the year, and although the number of operations was less than in the preceding year, it is stated that there was great improvement in the quality of the work performed.

As already stated, the Vaccination Report of Mysore for 1881-82 has not yet been received. In Coorg the total number of vaccinations performed by the special establishment in 1881-82 was 4,887 against 3,808 in 1880-81. Of these, 4,693 were primary cases with 4,279 successful operations, and 194 were re-vaccinations with 125 successful cases. The number successfully vaccinated per 1,000 of population was 24·70; 498 operations were performed by the medical subordinates attached to dispensaries, out of which 392 were successful. The total cost of the establishment was only Rs. 1,174, and the average cost of each successful case was Rs. 0-4-3 against Rs. 0-5-7 in 1880.

Civil Sanitary Works.

Out of the total income of the Bengal municipalities, Rs. 6,68,157, or 23·93 per cent., were spent on sanitary works. Besides this, Rs. 4,51,993 were expended on the construction and maintenance of roads. Much was also spent on conservancy and drainage. Now that the municipalities are to be relieved of the heavy charges on account of the police, it is to be hoped a much larger proportion of their income will in future be devoted to strictly sanitary purposes. The following works were projected or undertaken during the year. The Eden canal project for supplying good water to Burdwan and Hooghly was completed in December. A scheme was matured for supplying the town of Burdwan with filtered water from the Damuda. The re-opening of the old Gangoor river in the Burdwan district was contemplated; if this project be carried out, a large tract of country will be drained and supplied with good water. Steps were being taken to extend the supply from the Dacca waterworks to the whole of that town. At Darjeeling the water-supply scheme was to be extended to the Bhutea Busti. A lake was constructed in the Govindpore sub-division of the Maubhoom district. A scheme for improving the *Sitakund* at Monghyr was submitted to Government for sanction. The Dinagepore drainage scheme was completed at a cost of Rs. 57,342. The drainage of the town of Rungpore was improved by the construction of surface drains. The Lalbagh drainage in Moorshedabad was being carried out. Great improvements were effected in the drainage of the towns of Darjeeling and Gya. A scheme for the special drainage of certain portions of the suburbs of Calcutta was under consideration, and considerable progress was reported to have taken place in otherwise improving their sanitary condition. Schemes are now under consideration for still further developing the water-supply arrangements for Calcutta; and the local Government has promised to give a grant of Rs. 1,70,000 in aid of a measure for supplying the suburbs also, on condition that the work is to begin by the 1st January 1883.

No sanitary work of magnitude was either executed or undertaken during the year in the North-Western Provinces and Oudh. In the municipalities much good work of a minor character was effected as regards the construction of new drains and latrines, paving roads, filling in excavations, providing sources of pure water-supply, &c. At Cawnpore 13,509 feet of the new drainage system was constructed during the year. The insanitary condition of villages was also receiving attention in several districts; 30 villages in Bahraich and 65 in Jalaun were brought under rural sanitation rules somewhat

similar to those in force in the Banda district, and to which reference has been made in previous annual reports.

In the municipalities of the Punjab a sum of Rs. 9,09,637, or somewhat more than one-fourth of their total income, was expended on sanitary works, excluding vaccination, during the year under report. Of this amount, Rs. 2,23,801 were spent on roads and bridges, Rs. 88,865 on drainage and sewerage, and Rs. 85,629 on water supply, including the clearing and repairing of tanks, wells, &c. The chief sanitary event of the year in the province was the completion of the Lahore waterworks, from which an abundant supply of pure water for the use of the city and the suburbs is obtained. Plans and estimates for the water-supply and drainage works at Delhi have been completed, and some preliminary works have been commenced. In Ludhiana special measures have been taken to protect the water-supply of the town and the district from contamination. A scheme for supplying Rawalpindi with pure water, which was commenced in 1880, was about to be proceeded with. In the city of Peshawar a considerable sum has been spent in constructing masonry channels for sewage and for drinking water. At Delhi the old drains have been cleaned and opened up. At Lahore the drainage works are progressing satisfactorily. At Amritsar the main drainage scheme is nearly completed round the eastern side of the city, and the internal drainage has been improved by the adjustment of the street drains with the outer main drain. The subject of the drainage of the whole locality, with a view of obviating the swamping and water-logging of the soil has been taken up, and surveys have been made. In the Hoshiarpur district three drainage schemes have been carried out. In Jullundur much has been done to prevent the swamping of the land round the city during the rains, and a project for flushing the main drains of the city is in progress. In connexion with the waterworks at Simla, orders have recently been issued to construct the Sanjauli reservoir.

In the Central Provinces an extensive scheme for supplying the city and station of Jubbulpore with pure water at an estimated cost of six lacs of rupees was commenced during the year, and the works were being actively carried on. The Hinganghat waterworks, referred to in the last annual report, were fast approaching completion. Tanks were cleared and deepened at Damoh and Raipur. Rs. 1,611 were spent by the Saugor municipality on the Kunera waterworks. In many of the districts the sources of water-supply were improved, and drains were constructed; 353 wells were repaired, and 191 new ones were constructed. Out of a total income of Rs. 5,22,145, the municipalities spent Rs. 1,23,383 on their conservancy arrangements.

No work of any magnitude was executed or undertaken during the year under review in Berar. In the five municipalities of the province, Rs. 25,864 were spent on purely sanitary works, including conservancy drainage and water-supply. In the districts the total outlay on minor sanitary works amounted to Rs. 89,027. The Akhatwara tank was constructed by the Public Works Department at a cost of Rs. 3,656. Schemes for supplying Khamgaon with pure water-supply and draining the town were under consideration. Projects were in hand for a system of tanks in the Amraoti hills and in the valleys of the Melghat.

Nothing of any importance was executed during 1881 in Assam. The municipal reports of the province, with the exception of those for Gauhati and Sylhet, which have not been received, show that in all Rs. 37,694-11-10 were spent on sanitary improvements. Out of this sum Rs. 5,833-9-5 were expended on drainage, Rs. 1,663-10-10 on water-supply, Rs. 8,544-10-1 on conservancy, Rs. 17,788-13-0 on the construction of roads and culverts, and the balance on the improvement of village sites, &c. At Shillong the new system of water-supply which was extended in 1880 to the suburb of the Maokar village was further extended during the past year, so as to embrace the police bazar, the regimental lines and hospital, and the regimental bazar. A project for keeping out the floods of the Brahmaputra from the town of Goalpara has been sanctioned. A scheme for the water-supply of Gauhati is under consideration. At Nowgong Rs. 2,888-6-8 were spent on drainage and conservancy.

Many sanitary improvements were effected in several of the municipalities of British Burma. In Rangoon the waterworks for supplying the whole town and the shipping with pure water were being vigorously carried out, and the drainage was greatly improved, upwards of Rs. 50,000 having been devoted to this purpose. At Prome a project for completely draining the town was sanctioned, and the works were in progress; several public latrines were erected; a scheme for the water-supply of the town was under consideration, and efforts were being made to abolish gradually the cess-pit system. At Bassein 7,000 feet of masonry drains were constructed; a great part of the Athegyee swamp was reclaimed; additional public latrines were erected; the cess-pits were being

rapidly replaced by proper drains; and a scheme for supplying the town with pure water was being considered. In Toungoo Rs. 23,205 were expended on sanitary works by the municipality; masonry drains were being provided throughout the town and many wells were improved. In Henzada Rs. 97,000 were spent on sanitary works, the most important of which was the construction of masonry drains.

No work of any magnitude was undertaken or executed during the year in the municipalities or local fund circles of the Madras Presidency. The total estimated income of the municipalities for 1881-82, was Rs. 14,73,234. Out of this, Rs. 4,56,766 were allotted to sanitary purposes, but, as in the preceding year, the whole amount was not spent. Rs. 2,44,446 were spent on conservancy arrangements for the towns; Rs. 32,065 were laid out on improving town sites; Rs. 19,263 in improving the water-supply; Rs. 2,434 in making sanitary arrangements during fairs and festivals; Rs. 17,507 on the construction and repair of markets and slaughter-houses; and Rs. 36,486 on miscellaneous sanitary objects, such as the construction and repair of latrines, drains, dust-bins, &c. The total available income of the local fund circles for 1881-82 amounted to Rs. 13,51,399, of which Rs. 3,86,959 were assigned to sanitary purposes; but in no circle was the amount allotted fully utilised. The works consisted, in most of the circles, of the sinking and cleansing of wells, the digging of tanks, the construction of latrines, &c., and in improving village sites.

The latest municipal reports summarised by the Sanitary Commissioner of Bombay refer to 1880-81. The total income of the municipalities during that annual period amounted to Rs. 25,69,791, and out of this Rs. 6,33,713 were expended on conservancy arrangements. At Ahmedabad City, Rs. 26,752 were spent on new works of a sanitary nature and on repairing roads, drains, wells, &c. In the city of Broach, Rs. 20,782 were devoted to similar purposes. At Tanna a considerable area of marshy ground was reclaimed; the plan and estimate for the Pokhran waterworks were sanctioned, and suitable sites were purchased for new markets. At Alibag a scheme was under consideration for bringing water by pipes from the Kainone spring; and some ground was specially prepared for the manufacture of poudrette. At Ahmednagar Rs. 7,148 were spent on drains, roads, water-pillars, &c. At Jalgaon water-pipes were laid from the town to the old village, and a drain and four public latrines were constructed. In the city of Poona Rs. 30,132 were spent on roads, new works in connexion with water-supply, new drains and sewers, and on new latrines. At Sholapur the construction of reservoirs and steam pumps and erection of special steam pumps for raising water were completed, and the work of laying out pipes and erecting stand posts were about to be finished. At Vengurla and Chiplun the head waterworks were repaired and improved at an aggregate outlay of Rs. 11,159. At Rajapur the waterworks channel was improved at a cost of Rs. 1,882. At Ratnagiri the water-supply works were completed and repaired at a cost of Rs. 15,131. At Kurrachee the waterworks were progressing steadily and were already to some extent utilised. Some important improvements were also carried out in the waterworks of the town of Bombay.

General Remarks.

Local self-government.

The system of local self-government which has lately been inaugurated, and which is being generally introduced in all the Provinces of British India, cannot fail to have a decided influence on sanitary progress. The "Central Provinces Local Self-Government Bill" is now before the Legislature. It is intended to deal with the whole province, excepting the municipalities for which suitable provision has already been made. It proposes the formation of local administrative areas by the aggregation of villages in circles and groups for purposes of local self-government, the establishment of local boards and district councils, and also the making over to the control and administration of these boards and councils, among other matters, "the construction and repair of public wells, tanks, and waterworks, the supply of water from them and from other sources, and the preservation from pollution of water for drinking and cooking purposes," to which are added "any other local works or measures likely to promote the health, comfort, or convenience of the public." By giving over these matters, which embrace the whole range of sanitary works and improvements, to local management, there can be little doubt that the residents, who are primarily to be benefited by these improvements, will take an interest in them and bestir themselves regarding them in a way which they have never done hitherto. At the same time all the advantages to be derived from the inspection and supervision of the officers of the Government will remain. Freed from police charges, which have hitherto swallowed up a great portion of the local funds, much larger sums will be available for sanitary purposes. The

principles embodied in this Bill are generally the principles which will be acted on in bringing the system of local self-government into play in all the other Local Governments and Administrations.

The sanitary objects which will claim the attention of the new boards may be said to be practically unlimited. In a Resolution recently issued by the Government of Bengal it is mentioned that one of the most important functions they could perform would be the gradual improvement of the drainage, sanitation and water-supply of villages. It is suggested that bye-laws should be framed and published after confirmation by the Government, and, as an illustration of how funds may be raised in some districts for such purposes, the Lieutenant-Governor cites a very interesting account given by Mr. Beames, the Commissioner of Burdwan :—

“ In some parts of the Serampore sub-division there are very large and populous villages, among the inhabitants of which are many gentlemen of high intelligence and business habits. Some are retired officers of Government, others are pleaders and merchants, who go daily to their places of business in Calcutta. These gentlemen have undertaken the office of *Punchayet* under the Village Chowkidari Act, and finding a very great demand and necessity for sanitary improvements in their villages have availed themselves of the influence acquired by their appointment to induce the villagers to subscribe for such purposes. They have built culverts, made roads, and drained dirty places—all with funds freely contributed by the villagers. No possibility of oppression exists, as the villagers, from daily contact with the outer world, are far too well aware of their rights to permit themselves to be oppressed. Here and there a refractory villager refuses to subscribe, or cannot be induced to sacrifice some little corner of his holding for the purpose of making a drain, or refuses to put a stop to some nuisance which is offensive to his neighbours, on the ground that the *Punchayet* has no legal authority. The sub-divisional officer, Mr. Carstairs, has in all cases supported these enterprising *Punchayets* in every legal manner; but both he and they feel that some authority from Government is necessary to enable them to carry out the wishes of the majority. They do not wish to be made into municipalities or even unions, not being prepared to bear the burden or undergo the labour involved in maintaining municipal institutions. All that is necessary is that some addition should be made to the Village Chowkidari Act, or a chapter added to the Municipal Act.

This beginning, the Lieutenant-Governor remarks, modest though it is, promises good results, and the chapter of the law relating to this subject might legalize the levy of subscriptions for these purposes up to a fixed maximum.

The special report on the outbreak of so-called plague in Mesopotamia in 1881 has been received, and contains some interesting particulars. Surgeon-Major Bowman, Residency Surgeon of Baghdad, writes :—

“ As to the nature of the disease, from the statements of intelligent inhabitants of Nejef, and more especially those of the principal *mejtaheds* residing there and at Kerbella, the disease was a malignant, contagious, continued, fever, accompanied by an eruption of buboes on the cervical, axillary, or inguinal glands, or of carbuncles in the same regions, death occurring within a few hours, or about the fifth day; in children the mortality being extreme; also very high with adults. A previous attack was not any protection against a recurrence of the disease. I was unable to ascertain the period of incubation.

“ The disease appeared, and was limited to the country situated within longitude 44° to 45° and latitude 31°, 25° to 32°, 30°, which is generally low-lying, flat and swampy, and during the spring of most years, inundated by the overflow of the River Euphrates. From the statements of residents, the disease first burst forth at Shinafiyeh, a large village situated at the south of the Sea of Nejef. (The inland lake called the Sea of Nejef was formed 60 years ago by an unusual high rise of the Euphrates, and is still supplied by a branch of the same river, in addition to some fresh springs at the north, and salt springs close to the Nejef shore. The length is 45 miles, and varies in breadth, being about eight miles across opposite Nejef. The water is brackish, but animals readily drink it. The shores are gradually shelving, but deep in the centre. Small boats navigate the lake.) The soil of the country is generally a rich alluvium, on which much rice is cultivated; but to the west is a flat, sandy desert. Nejef, where the disease was very fatal, is a large town with very high walls, containing about 13,000 inhabitants, a place of pilgrimage and of great sanctity to Sheeah Mahomedans, as the tomb of Ali is placed within its walls, and over a large tract of country outside the plain, presents the appearance of a vast cemetery, being the final burial place of numbers of Sheeah Mahomedans. The Shahs of Persia and other notables are buried inside the inclosure of the tomb of Ali. Nejef is situated upon the highest part of a plain, bounded on the south by what are called cliffs between it and the lake, on the other three sides by the plain, built upon limestone rock, and about 80 feet above the level of the surrounding country. The streets are very narrow, and encircle the tomb. The houses are small and confined, the entrance to many being below the level of the street. The rooms are small and very low; in the hot weather the inhabitants pass the day in deep *sardabs* excavated in the limestone, spending the night upon the roof. The thorough ventilation of the town is much impeded by the height of the city walls and narrowness of the streets; the gates of which there are two) are closed from sunset to sunrise. The sanitary state is highly defective, especially on occasions like the 11th of November, when 3,000 persons, in addition to the inhabitants, are stated to have attended the religious ceremony held on that date, all crowded into the town with

their numerous riding and baggage animals. The conservancy is nominally carried on by a municipality, but the arrangements for cleansing the town are of the most crude nature. In riding round and through the town on the 11th November, I remarked the open space between the city wall and the nearest house was used as a latrine; there are no public latrines, and very few houses have any arrangements for the reception of human excreta. Within and outside the town there is no vegetation of any kind, as the limestone rock is but scantily covered by a fine sand, apparently the detritus from the rock. Nejef is now supplied with excellent water by a cutting from the Hindiah Canal from the Euphrates, which was made by some benevolent Mahomedans (Indians and Persians) a few years ago. The termination of the canal is utilised to work some flour mills and water a garden on the shore of the lake. The profits from the mills are employed in keeping the cutting in repair."

As regards the alleged contagious character of the disease, this was generally believed in, and instances are adduced in support of this belief; but Dr. Bowman observes that "there are, in my opinion, no conclusive facts to prove that the disease was of a contagious nature." Dr. Bowman himself visited the districts which suffered most severely, and was thus able to speak from information derived at the localities. He states that it is generally believed that "the disease, now called plague, is the same disease that prevailed in Mesopotamia in 1876; but there is no evidence to show that it ever appears in isolated places, though the virulence of the epidemic varies in intensity in different places." As regards the land quarantine measures which were resorted to, the reporter is unable to state how far they proved efficient in preventing inter-communication between the different localities, and adds: "I have been repeatedly informed that intercourse was kept up, and all the regulations evaded." There was no evidence whatever adduced to show that this disease had been witnessed on board any ships which had called at ports in the Persian Gulf, or that it had been brought by the ships to ports outside the Gulf. In this respect the experience of the present outbreak was but a repetition of the experience acquired when the disease was so prevalent in Mesopotamia during 1876. The disease was purely local in its character, and it may therefore be inferred that it was due to local causes. In a practical point of view, there is no evidence to show that the restrictive measures adopted, either by land or sea, were in any way to be credited with keeping the disease within its local limits.

Quarantine regulations.

Quarantine regulations were enforced at the ports of Kurrachee, Bombay, and Aden during the earlier half of 1881 against the supposed plague in Mesopotamia. One of the most prominent features in the sanitary history of the year under review, as well as of the current year, has been the persistent efforts which have been made by the International Board of Health at Constantinople to place Indian ports in quarantine. Such restrictions have been imposed at Suez on account of cholera, notwithstanding that special measures had been adopted at all Indian ports in order to satisfy the International Board. Quarantine has also been instituted at Brindisi and other Mediterranean ports, and, for a time, in order to save more serious complications, it was actually necessary to impose a quarantine on ships coming to India from Sumatra and Java, as, otherwise, Indian ports would have been compromised, and ships leaving them for the Red Sea would have been refused *pratique* at Suez. Such action at any Indian port would be extraordinary; but to demand a quarantine at Calcutta in order to preserve that port from contamination by cholera from Sumatra and Java, or any other place, is the most extraordinary demand that well could have been made by any sanitary authority. Calcutta always has, and, so far as is known, always has had cholera more or less; and so well is this known that the portion of Bengal in which it is situated has been regarded and pointed to by the various International Sanitary Conferences as the *home* of cholera. All these quarantine restrictions have caused grave interference with trade, and serious inconvenience to passengers. The question is still under discussion, and, so far, the International Board has declined to abate its action. The position which the Government of India has taken is that this is a matter which should be regulated, not by theory, but by practical experience. If the theories of contagious germs were correct, then it might be expected that ships would prove the means of conveying them from one country to another, but the Government have nothing to do with such theories. The only question they have to deal with is whether the public health has suffered from free communication, and if so, how this danger may best be met. But as a matter of fact there is no evidence of such danger. The danger of cholera being imported by ships into Europe through Egypt seems to be, at least to a large extent, imaginary. During all the years that India has been in constant communication with Egypt, there has been no instance of any such importation. The only instance in which a serious attempt has been made to show that such had been the case—the alleged transference of the disease from Bombay to Aden in the S.S. "Columbian"—has already been fully disposed of and need not be referred to further.

From the facts collected by Mr. Netten Radcliffe* we learn that, between 1865 and 1880, cholera has been present in one or other part of Europe in ten out of these 16 years, but in no case did it appear along the Red Sea route. If, then, cholera in Europe has been due to importation from India, the importation must have taken place by land, and not by sea.

The restrictions which have recently been imposed by the Constantinople authorities on the pilgrim traffic between this country and Jeddah also deserve mention. The most important of these are the necessity for pilgrims to the Hedjaz providing themselves with passports, and the imposition of quarantine on all pilgrim ships at the Island of Camaran in the Red Sea, even when they are provided with perfectly clean bills of health, and have had no suspicious cases on board. The provision of passports, though vexatious to the pilgrims, may be productive, indirectly, of some good, but the orders enforced by the Turkish Government as to quarantining all pilgrims at Camaran, may be productive of great hardship, and there is reason to fear that they have already proved so. It is to be hoped that the recent appointment of a Mahomedan medical gentleman as Vice-Consul at Jeddah may in some measure mitigate the hardships which Indian pilgrims have to undergo, by giving them the opportunity of appealing to a fellow-countryman and a co-religionist for assistance.

The issue of a volume of the "Vital Statistics of India" deserves to be mentioned. It embraces the statistics of sickness and mortality in the European army of the three Presidencies during the ten years 1870-79. It was commenced by the late Surgeon-Major J. L. Bryden, in continuation of a similar volume dealing with the European troops of the Bengal Presidency for the ten years 1860-69, and has been completed by his successor in the Statistical Office, Surgeon-Major A. Stephen. Frequent reference has already been made to the figures it contains in the section of the report which deals with the European army.

"Vital statistics of India."

* Report of Medical Officer of the Privy Council, Series V., 1875. Report by Mr. Netten Radcliffe in Transactions of the Epidemiological Society, Vol. IV., Part IV., 1882.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR MADRAS FOR 1881.

(Dr. M. C. Furnell).

European Troops.

Sickness and
mortality
among
European
troops.

On the 1st January 1881 the strength of British troops borne upon the rolls of the Madras Army was 10,349, and on the 1st January 1882, 10,521, showing an increase of 172. The admissions into hospital were 1,164·8, which is a less admission than 1880. The mortality was slightly higher, but is a more favourable death return, excepting 1880, that we have for the past 20 years.

The subjoined table gives the ratio of admissions, daily sick, mortality, and invaliding since 1870:—

Years.	Admitted.	Daily Sick.	Died in and out of Hospital.	Invalided.	
				Change of Climate.	For Discharge.
1870 - -	1,481·5	63·6	19·7	70·4	6·6
1871 - -	1,211·5	56·2	19·1	29·7	12·5
1872 - -	1,352·3	59·7	19·2	26·8	11·2
1873 - -	1,270·8	59·3	18·5	50·6	12·7
1874 - -	1,141·2	57·6	13·4	29·5	8·3
1875 - -	1,096·3	56·9	14·8	60·8	15·5
1876 - -	1,132·9	55·2	16·1	31·9	10·9
1877 - -	1,172·2	58·7	17·2	36·0	10·2
1878 - -	1,379·7	65·8	22·1	36·6	9·1
1879 - -	1,438·7	68·4	16·8	34·3	10·2
1880 - -	1,385·4	68·4	9·9	15·0	8·0
1881 - -	1,164·8	68·2	11·1	No return received.	

During the year there were eight cases of small-pox, all at Bangalore, one of which proved fatal.

The admissions and deaths from fevers this year compare favourably with the last preceding three years. There were 2,880 admissions, of which seven died; last year the admissions were 4,621, of which 16 proved fatal. By far the largest number of entries is, as usual, under the head of intermittent fevers; out of the total, 2,880 no less than 2,100 were from this cause, but none proved fatal. Continued and remittent fevers together numbered only 771 cases, of which two proved fatal. Last year there were 1,196, of which five died. By far the largest number of cases of continued fever are from Thayetmyo, which last year also was noticeable for the same fact, whilst Bellary has none and Secunderabad only 22 cases. These stations last year were bracketed with Thayetmyo.

This year there are only nine entries under typhoid fever, of which five proved fatal. I commented in last (and the year before) annual report upon the unreliability of these entries. On reading over the abstract of cases, it is very evident that the entry to typhoid fever is only made when a case of continued fever assumes grave symptoms, whilst in some *post mortem* notes of fatal cases entered under remittent fever we find such notes as the following: "There were large patches of ulceration about 2 inches in length by one in breadth. In the lower part of the ileum the glands were swollen and raised above the surface and presented a blackened appearance, &c." However, it is satisfactory to note that under all three heads—remittent, typhoid, and continued fevers—the entries are considerably less this year than last.

There were 35 cases of epidemic cholera during the latter part of the year—25 in Kamptee, three in Secunderabad, and seven in Thayetmyo. Last year not a single case occurred amongst Her Majesty's troops serving in Southern India.

The number of admissions and deaths from sunstroke and apoplexy compares favourably with the past year—28 admissions and seven deaths. This year there were only

two admissions and no deaths in Kamptee as against 19 admissions and two deaths in 1880.

As usual there is a large entry under hepatic diseases—403 admissions with 16 deaths—but this compares favourably with the preceding two years. Last year there were 457 admissions with 15 deaths.

The admissions under venereal diseases, although very great during the past year, viz. 2,257, compares favourably with past years. Madras, as usual, exhibits a very high ratio.

Native Troops.

The strength of the Madras Native Army on January 1st, 1881, was 30,763. During the year there was a decrease by invaliding, desertions, deaths, &c., of 2,485, and an increase by recruiting, transfers, &c., of 2,040, leaving a total of 30,318 present on January 1st, 1882. Of these we have the medical returns only of 23,314 furnished to this office; the remaining 7,004, it is presumed, are serving outside the limits of the Madras command. Of this number (23,314) there were 22,119 admissions into hospital and 380 deaths, giving a ratio of deaths per 1,000 of 16·2. The deaths amongst the civil population during the same period was 16·2 per 1,000; in England it is 18·6.

Sickness and mortality among Native troops.

Below is given a table which shows at a glance these facts contrasted with those of the previous 13 years. From this table it will be seen that, although the number of admissions into hospital is somewhat less, the deaths and invaliding are higher. This, no doubt, is a legacy of the Afghan and Rampa disturbances of the previous year, added to some cases of cholera which occurred at Kamptee and Trichinopoly :—

	Ratio per 1,000 of Strength.													
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Admissions -	707·4	702·5	630·6	665·9	1,067·9	883·2	772·7	777·7	726·8	832·2	793·2	1,001·2	1,275·0	948·7
Daily sick -	29·0	29·3	26·4	26·9	34·7	31·3	30·0	30·7	28·2	28·8	29·7	40·4	55·8	44·6
Deaths in hospital -	8·6	10·1	9·4	8·8	9·9	6·4	7·7	9·0	9·8	11·3	11·7	11·8	13·3	13·2
Deaths out of hospital -	1·4	3·6	3·6	1·8	2·4	1·8	2·0	1·5	1·2	1·7	1·6	2·4	2·4	3·0
Invaliding -	16·4	24·5	25·6	23·3	28·4	30·8	35·5	39·3	37·1	30·5	52·6	38·9	31·8	47·0

The greatest number of sick, as usual, come under the heads of fevers, bowel-complaints, and skin diseases. But this year rheumatism swells the return with 951 admissions and cholera 75 cases.

There were 8,673 admissions with 38 deaths from intermittent fever, which is an improvement on last year; Bellary, Secunderabad, Kamptee, and Rangoon returning the most numbers, Rangoon having by far the greatest number of deaths.

Of cholera there were 75 admissions with 31 deaths. Of these Kamptee had 24 admissions with six deaths, and Trichinopoly 39 admissions with 18 deaths.

There were 33 admissions with three deaths under small-pox. Last year there were 23 with two deaths.

Jails.

From the medical returns furnished to this office the average strength of the jails during 1881 was 10,322, of whom 7,664 were admitted into hospital and 428 died, being 5·5 deaths per cent. of admissions about the same, but slightly higher than last year.

Sickness and mortality in jails.

Of the 7,664 admissions into hospital no less than 2,645 were under the head of fever, 2,379 being intermittent fevers; of these Rajahmundry central jail alone gives more than one-half (1,315). Dysentery and diarrhoea are responsible for 1,277 of the remaining cases, and there are 90 admissions under cholera.

The immunity from cholera enjoyed by the jails during 1880 was unfortunately broken during 1881. The epidemic which swept over Southern India at the end of the year, and which is still existing whilst I write, visited the central and district jails of Trichinopoly. Of the 90 cases of cholera borne on the year's return no less than 88 took place in these two jails, 4 in the district and 84 in the central jails, and they are answerable for the whole of the 33 deaths recorded from this cause. I visited the Trichinopoly jail in March 1881 and can quite bear out the remarks of the Superintendent in his annual report to this office, viz., "the jail is scrupulously clean in every respect," and that "the water-supply is good, water clean, soft and pure, and free from salines." The food is reported to be strictly according to the scale laid down in the regulations.

The Medical Officer in charge thus reports: "Cholera was prevalent in the town twenty days previous to its outbreak in the central jail, and it was probably communicated by contractors, servants, warders, and policemen coming into the jail from the town." The Inspector-General of Jails, Colonel Tennant, considers this supposition quite untenable, and points to the fact that "the first prisoner attacked was a Burman

" who had never been outside the jail walls since his admission. This prisoner slept in No. 5 block and worked in No. 4, and it so happened that this particular Burmese prisoner did not come in contact with the persons mentioned in Surgeon-Major Thomas' letter as being likely people to communicate the disease." The evidence on which this latter statement is made is not however given.

Colonel Tennant seems inclined to attribute the outbreak to the position of the municipal filth depôt in regard to the central jail. "Whilst at Trichinopoly," he writes, "I visited the municipal filth depôt. It was evident that the filth had been thrown on the ground and left seething in the sun and not covered up in pits; the smell was something frightful, and the filth lay exposed although endeavours had recently been made to cover it over with earth. When cholera was prevalent in the town it is but reasonable to infer that choleraic discharges were carted away with the filth and thrown on the ground at the depôt. The wind blew from the direction of the filth depôt towards the market place, and I understand that cholera was very bad in that part of the town. Mr. Johnston informs me that about the middle of November the wind changed and blew directly over from the depôt to the central jail. The distance, as the crow flies, from the filth depôt to the central jail, I should say, is a little over a mile, and it may be a question for sanitary consideration whether this may not have been the cause of the outbreak of cholera in the central jail at Trichinopoly." I think this theory is well worthy of consideration.

The Medical Officer having furnished me with a copy of his letter, I ventured to address the following recommendation to the Inspector-General of Jails: "Whether it would not be politic, when cholera is present in any town where a central or district jail is situated, to issue an order compelling all warders, policemen, contractors, servants, &c., having access to the said jail to report immediately any cases of cholera occurring in their houses or immediate vicinity of their residences, so that precautions might be taken to prevent their mixing with the prisoners." To this I received no reply.

As a practical medical man I should feel inclined in a case like Trichinopoly, having in view that our knowledge of how cholera is spread is but conjectural, to adopt both precautions. Have the filth depôt, if possible, removed to a greater distance, at any rate properly covered and looked after; and forbid, if possible, the warders and other attendants, during the continuance of the epidemic, sleeping in or visiting the town which is two or three miles distant.

Small-pox occurred in four jails only. There were six cases altogether and only one death, which is even a more favourable state of things than last year.

There were only 1,277 cases returned this year as against 1,479 last year and 2,111 in 1879. The percentage of deaths to admissions under this head is still very high, 12·7. The percentage of deaths to admissions is as follows in the jails which show the highest deaths from dysentery and diarrhœa:—

			Per cent.
Trichinopoly Central	-	-	24·2
do. District	-	-	46·2
Cannanore	-	-	31·9
Rajahmundry Central	-	-	14·3

In G.O., Nos 1361 and 1362 of 6th October 1881, attention is drawn in the despatch of the Most Honourable the Secretary of State for India to the excessive mortality in the Coimbatore and Tanjore jails which points, according to the opinion of the Army Sanitary Commission, to something radically wrong. In a subsequent despatch the mortality in certain jails is described as still excessive and demanding inquiry.

In obedience to the above G.O. I visited the Coimbatore jail, and I herewith subjoin the substance of the report I made to Government on the matter:—

"The subject has been so fully gone into by the Inspector-General of Jails in his letter No. 163, dated 29th August 1881, that it seems needless to repeat the arguments he adduces in explanation of this apparent excessive mortality, due evidently to the exceptional years. Confining myself, therefore, simply to my inspection, I have to report that I carefully went over the Coimbatore jail on two successive mornings with the Medical Officer and Superintendent examining the prisoners, their clothing, food, water-supply, dormitories, latrines, &c. I found the whole body in admirable health, strong and well able to do the work allotted to them; no trace of anæmia or scurvy. There were 1,027 prisoners in the central and 133 in the district jail = 1,160; total sick 13, a little more than one per cent. Of these sick only two were seriously so. The only suggestion I was able to make was some alteration in the filtering arrangements of the drinking water which the Superintendent promised to attend to."

The Tanjore jail, which stands highest in relative mortality this year, giving a death-rate of 165·5 per 1,000, has long been condemned and should be abandoned.

General Population.

As remarked in last year's report, no change has taken place in the mode or machinery of registering births and deaths. The returns can, therefore, only be looked upon as approximative; and, until some simple legal measure is passed defining the duties of village accountants, and making the duty of reporting births and deaths to that official compulsory on every householder, they must continue to remain so. Vital statistics.

The total births registered were 731,866, giving a ratio of 25·5 per 1,000, the largest number of births and the highest ratio for the past 12 years. This means, most probably, that not only were there more births, but that the registration, imperfect as it is, is on the whole improving. Of the 731,866 births, 375,816 were males and 356,050 females, being a proportion of 105·7 males born for every 100 females. This is much the proportion that the past year's registration has shown.

There were registered 465,682 deaths during 1881, being an increase over those of 1880. The death ratio per 1,000 was 16·2 as compared with 15·7 in 1880. This is a slight increase over 1880, but is less than any of the 11 years previous. If the returns were from a reliable registration it would point, as remarked last year, to a death-rate less than in great Britain. It cannot, however, be so taken, and the only safe conclusion is that, compared with the past 12 years, 1881 was a favourable year in a sanitary point of view.

Of the deaths registered, 239,494 were males and 226,188 females, showing a preponderance of death amongst males in the proportion of 105·8 to 100. Last year it was Tanjore and Trichinopoly which showed a preponderance of female over male deaths; this year the districts of Tanjore, Madras, Cuddapah, and North Arcot have that distinction. But Tanjore heads the list very markedly, there having died in that district 24,141 females to 23,820 males.

The death-rates in towns was 22·8 per 1,000, which is a slight increase over last year, when it was 21·8 per 1000, but it still compares favourably with the average for five years before the famine, 26·6. The death-rate in the rural population was 15·2 per 1,000, which also is an increase over 1880 (15·4), but it compares favourably with the average, 21·1 per 1,000.

The singular immunity from death which characterised the Native Christians of Ganjam and Madura during the previous two years would seem to have passed away; still the mortality is very low. In Ganjam, out of a population of 645, three only died, which represents a ratio of 4·6 per 1,000; in Madura it was slightly higher. Taken altogether, however, the mortality amongst Native Christians throughout the Presidency is apparently higher than amongst Mahomedans and Hindus. Native Christians 19·2, Mahomedans 15·8, Hindus 16·2 per 1,000.

The following return gives the deaths from different causes during the year under review. It will be seen that, although not so good a year as 1880, it still is better than any of its predecessors, until we go back to 1871. The increase in the year is due almost entirely to deaths from cholera, of which there were 9,446 as compared with 613 of the previous year. Fevers and bowel-complaints were not quite so high as last year:—

Years.	Total Deaths.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	Other Causes.
1866 - - -	600,106	200,961	23,106	110,102	—	9,047	256,890
1867 - - -	372,026	33,205	27,907	112,511	—	8,613	189,790
1868 - - -	390,959	8,036	34,330	105,692	—	9,242	233,659
1869 - - -	451,981	21,034	17,448	132,346	—	9,310	271,843
1870 - - -	451,020	55,867	11,252	151,027	—	12,325	220,549
1871 - - -	444,371	17,656	20,823	192,469	38,928	15,323	159,172
1872 - - -	501,482	13,247	39,074	214,148	39,387	15,150	180,476
1873 - - -	506,894	840	51,784	222,843	36,392	14,251	180,784
1874 - - -	516,848	313	48,343	226,220	37,993	13,065	190,914
1875 - - -	641,260	94,546	24,775	252,042	37,484	12,421	219,992
1876 - - -	680,384	148,193	23,469	230,092	38,176	11,175	229,279
1877 - - -	1,556,312	357,430	88,321	469,241	133,366	16,460	491,494
1878 - - -	810,921	47,167	56,360	374,443	48,083	15,007	269,861
1879 - - -	549,390	13,296	17,840	285,477	23,218	12,619	196,940
1880 - - -	454,101	613	14,529	209,940	19,622	10,845	198,552
1881 - - -	465,682	9,446	15,776	203,542	18,961	11,527	206,430

Cholera.

The immunity from cholera, so characteristic of 1880, continued during the greater part of 1881, but during the last quarter this pestilence made its appearance in the southern part of the Presidency, carrying off 9,446 victims. Of these 2,220 were registered as having died in the towns and 7,226 in the districts. The Ganjam District, which returned almost all the deaths during 1880, returned only 159 this year, all of which cases occurred in the early months.

The disease was known to be prevalent in the adjoining part of the Presidency of Bombay, and, judging from past experience, it was expected to make its way down to Madras. In September 1881 the Surgeon-General sounded a key-note of warning, calling upon all Zillah and Civil Surgeons to be prepared for its advent, and shortly afterwards the Government published in the Gazette a similar warning to all Presidents of Municipal and Local Fund Boards from this office. The warnings were promptly acted on.

Small-pox.

In last year's report it was remarked that small-pox, like cholera, had been less fatal during the year under review; this year the exact converse is the case. Small-pox, like cholera, has been more fatal. There were 15,776 deaths registered under this head as against 14,529 during 1880; of these 8,063 were males and 7,713 females. As usual, Ganjam heads the list of mortality under this head, followed by Tinnevely, North Arcot, Madras, and Chingleput. Last year the list was Ganjam, Tinnevely, North Arcot, Chingleput, and Malabar—almost indently the same.

In Ganjam, where I was on tour quite lately, I am given to understand inoculation is still largely practised in the more remote parts, which no doubt accounts for the unenviable pre-eminence this district enjoys from small-pox mortality.

Since 1879 attention has been drawn to the large proportion of deaths amongst children under 12 in the table of small-pox mortality. In 1879 about one-half were so returned; in 1880 considerably more than one-half—indeed nearly two-thirds of the deaths took place in children under 12. This year considerably more than two-thirds, viz., 11,202 deaths, out of a gross mortality of 15,776 registered in the districts, took place in young children:

In the annual reports of 1879 and 1880 the subject was fully entered upon, and it does not seem desirable to travel over the same ground again. I can only repeat the observation of last year, endorsed by Government in their Order No. 1423 of 20th October 1881: "The Sanitary Commissioner can but yearly draw attention to the large mortality amongst children from small-pox, in the hope that it will in time be recognised by Native gentlemen and others forming local fund and municipal bodies, that in early vaccination lies the greatest protection not only to individuals, but to communities."

Fevers.

Fevers form, as usual, by far the largest sum of mortality; out of a gross total of 465,682 deaths, 203,542 are returned as fevers. I confess myself at a loss to account for this persistent and ever increasing death-roll from fevers, unless it be the habit which obtains amongst the people all over the country of poisoning, by filthy practices, their water-supply, and their exposure by reason of their very scanty clothing to vicissitudes of temperature. But these are not new customs.

Bowel complaints.

There are fewer deaths returned under this head than last year or any previous year of which we have records. The probability is that many deaths which would have been returned under this head have been included under cholera. The number returned is 18,961, of which 10,023 were males and 8,938 females.

Vaccination.

The total numbers vaccinated during 1881 fall short of the numbers vaccinated during 1880 by 58,537. This is accounted for satisfactorily by the necessary decrease in Tanjore after the past year's efforts. The number in that collectorate alone show a decrease of 116,216, more than sufficient to account for the whole falling off. The numbers vaccinated during 1881, however, compare favourably with the numbers during any previous year omitting 1880. The percentage of successful vaccinations is even better than last year, which was an improvement on its predecessor; out of 590,681 primary vaccinations there were 538,152 successful, giving a percentage of 91.1 as against 88.72 in the previous year; and out of 10,541 re-vaccinations 6,858 were successful, being 65.06 per cent. against 50.42 in 1880.

Infantile vaccination seems to be slowly progressing, the number vaccinated in the districts under one year being 75,710; but this is still only 11.1 per cent. of the

registered birth-rate, probably not 8 per cent. of the actual births. Coimbatore takes the lead in infantile vaccination, 12,124 having been thus protected.

In the municipalities there was also a slight increase in infantile vaccination, but it is much below what it should be. In this respect Madras heads the list with 8,456, and Anakapalle, with a population of 13,044, returns only 5.

The average cost of each successful case is annas 4-9, which is a slight increase over last year of 5 pies per case. In the districts the cost varied from annas 14-1 in Cuddapah (Madanapalle Circle) to annas 2-4 in Coimbatore. In municipalities from Rs. 1-10-10 in Wárajápet to annas 1-9 in Máyavaram.

Dr. Price remarks: "In my opinion more inspectors and deputy inspectors are required if the vaccination is to be first class and none other is thoroughly protective. A deputy inspector ought to be able to see each vaccinator in his circle at least once in every three months. (Some of the circles at present are so large as to render this impossible.) The inspector ought to be able to visit each deputy at least once in every six months. At present he is only expected to see each of them once in two years, and even to do this he must run over them, there not being time to give each a thorough inspection."

Sanitary Works.

From only 46 of the 48 municipal towns were sanitary reports received. Rajahmundry* and Coonoor furnished none. The sanitary works executed were of a nature similar to those carried out in former years. Details are given in the abstract of notes under this head for each municipality.

The total estimated income of all the towns, excluding Madras, amounted to Rs. 14,73,234, being an average of Rs. 1-3-4 per head of population. Of this amount Rs. 4,56,766 were sanctioned for sanitary purposes for the year 1881-82, or 31·0 per cent. of income. The allotment on the whole appears to be satisfactory; and even in individual towns there is nothing to complain of in regard to the provision made for sanitation, except in Calicut, Ongole, Mangalore, Chidambaram, Cocanada, Pálghat, Negapatam, and Palamcottah, in all of which the allotment was below 20 per cent. of income. But it is to be regretted that the whole sanctioned allotment has not been fully made use of: out of an aggregate allotment of Rs. 4,56,766 only Rs. 3,34,703 were spent, leaving Rs. 1,22,063 or a little more than one-fourth unutilised, and this difference is distributed among all the municipalities. In none was the full sanctioned sanitary allotment made use of except Tanjore, Máyavaram, and Negapatam which have exceeded their grants.

Sanitary reports were received from 31 Local Fund Circles, being less by one than those which furnished reports in 1880, as the two circles in the Malabar District, Calicut and Tellicherry, were amalgamated. Sanitary work consisted, as usual, in most of the circles, in the sinking of wells and excavating tanks, in the erection of latrines, dust-bins and cinerators, repairing and cleansing tanks and wells, removing rank vegetation, and improving village sites by the levelling and repairing of the streets, &c., and some other minor works. In some circles more works were carried out than in others. Coimbatore spent the most during the year, viz., Rs. 40,856 (including Rs. 8,203 for conservancy and Rs. 28,626 for the construction and repair of markets and slaughter-houses) in the execution of some sanitary work or another, while Canara spent the least, only Rs. 868.

The aggregate available income (*i.e.*, one-third of the land-cess) for the year 1881-82 amounted to Rs. 13,51,399; of this amount Rs. 3,86,959 were allotted and sanctioned for sanitary purposes. This sum does not include the allotment for the construction and repair of markets and slaughter-houses. The proportion it bears to available income is 28·7, being 4·6 per cent. in excess of the grant for the past year, 1880-81; it may, on the whole, be considered a fair allotment. Taking each individual circle too, the allotments appear to be fairly satisfactory. Eliminating Malabar, for reasons given in last year's report, in no circle is the grant less than 16 per cent., except Chatrapur, which has allotted only 11·9, and Bellary 8·7 per cent. Guntúr, Negapatam, Ellore, and Tanjore stand high up in the list with an allotment of 84·8, 68·6, 63·7, and 61·4 per cent. In the other circles the allotments varied from 43·1 per cent. in Kurnool to 8·7 in Bellary.

While the sanitary allotment taken collectively as a whole, or individually, except in a few circles, appears to be satisfactory, it is very much to be regretted that the

* Was received subsequently, but too late for incorporation in the report.

amount sanctioned has in no instance been fully utilised. In my last Sanitary Report for 1880, I pointed this out in certain instances for which I had information; and seeing this to be the case in some circles, I was induced to call for particulars from all of them, and the result shows that for 1880-81 and 1881-82 in no circle has the whole sanctioned sanitary grant been fully utilised. In 1880-81, out of an aggregate sanctioned allotment of Rs. 3,58,121, only Rs. 2,52,134 were spent, leaving little less than one-third unused. In 1881-82 it is still worse; out of an aggregate allotment of Rs. 3,86,959 which was sanctioned for sanitary purposes, only Rs. 2,01,546 were so used, leaving more than one-third unexpended. In some circles even more than one-half was not utilised.

General Remarks.

During the year under review I visited Coimbatore, Salem, Pálghat, and from thence all the municipal towns in the Western Coast as far as Mangalore, and subsequently the Northern Circars from Ganjam to Vizagapatam, returning to Madras at the end of March.

In my last annual report, I mentioned that the impression left on my mind from touring, was that the great needs in sanitation were (1) improved water conservancy (2) removal of filth from the interior and surroundings of houses. I must say my recent travels have but confirmed my first impression, only that I should feel inclined to put the first, viz., necessity of water conservancy, a long way before any other.

The people of India, and I am speaking of the multitude, the million, compare, I think, favourably as regards the interior of their houses with the multitude in European countries. I am, or was, as a doctor, well acquainted with the interior of the houses of the poorer classes of England, Wales, and some towns of France, and I must candidly say I have found less repulsive filth in the interior of the houses of the people of this country, especially in the mofussil, than amongst people of the same class in Europe. But the treatment that drinking water undergoes in this country is not only appalling, but perfectly inexplicable considering that it is so diametrically opposed to the commands laid down in their holy Vedas.

In the third or Yagur Veda, the part called Arana contains the following commandments:—"Do not spit out with retching in the water. Do not pass urine or discharge excreta in the water. Do not drop blood into water. Do not throw any hair, or nails, or bones or ashes, nor dip dirty clothes into water. For to do so is to abuse a precious gift of the gods and disgrace them."

Menu the Lawgiver, says:—"Let him not cast into the water either urine, or ordure, nor saliva, nor cloth, nor any other thing soiled with impurity, nor blood, nor any other kind of poison."

Nothing therefore can be plainer than the commands of their own lawgivers on this point, and yet from Cape Comorin to Cuttack, and from Madras to Mangalore, the whole length and breadth of our Presidency, and—from letters I have received from Bengal since I lectured on this matter at Patcheappah's Hall—most probably I might fairly say the whole length and breadth of India every tank and water-source is more or less defiled by "spitting with retching, passing urine and other excreta, and washing filthy rags in the water."

In my report for 1880 I wrote: "I carefully watched at some tanks, for instance, at Hosúr, Bellary, Májavaram, &c., people washing their clothes and persons in tanks, from which the women were taking home vessels laden with water for cooking and drinking. This water, in one or two places, when examined, was found to give every possible evidence of impurity, &c." I have continued this examination at every place I have visited and found the practice the same. It is not that the water contains a thousandth part more or less of a miligramme per litre of ammonia or any other objectionable salt, such as analytical chemists determine with so much nicety in Europe, it is that the water is to the naked eye and nose in almost every instance, a palpably unclean, offensive, dirty fluid, in which almost any amount of a solution of the permanganate of potash dropped in loses its colour. It would rank in Europe as simple sewage.

And less I should be deemed guilty of exaggeration, let me add a few notes of what I have seen in recent tours. In Coimbatore, situated in the middle of the town is a splendid well called Ananta Iyer's well. It must have cost a great deal of money to construct and is really a magnificent well, giving an abundance of clean, sparkling, cool water, even in the hottest weather; but owing to neglect is defiled every day. The yard in which is the well, is paved with large flag-stones, but these in course of time, have, in many places become displaced, and the consequence is that the water in which the

people around, after the custom in India, and a very bad custom it is, have washed their bodies and clothes, trickles back into the well through the sodden earth, instead of running clear away as was intended when the well was originally constructed. Looking at the well whilst the process of washing, &c., was going on all around, we could see the water streaming back down the side of the well, the wall of which was discovered from the percolation.

When the cholera was making its way down from the north-west to our Presidency at the end of the last and commencement of this year, I was asked by Mr. Price, Collector of Chingleput, to send him a few simple rules on sanitation of villages, that he might publish them in his District Gazette. Subsequently hearing from him that the rules I had sent answered the purpose and were sufficiently simple and intelligible to the people, I took it upon myself to send a copy of them to all Presidents of Municipalities and Local Fund Boards. Lately I found myself inspecting a municipality in the North (Berhampore) a long way from Madras, and the manager showed me amongst the proceedings of the Commissioners of that municipality, a resolution calling attention to my circular, and resolving that two important tanks which I will call A and B, should be strictly set aside for drinking purposes, and a policeman set over each to prevent people washing their bodies and clothes therein. Next morning we were going round the town, when the manager pointed out in the distance a bank which he said was the bund of tank A, one of the tanks in which washing of clothes and bodies were strictly prohibited. We went, the doctor of the station as well as the manager of the municipality were with me. We were soon there, and certainly it was a magnificent tank. There were crowds of people at all four sides and all, or nearly all busily engaged in washing their clothes, and those that were not doing that were bathing their bodies. Just where we had reached the tank was an old man washing a not very clean cloth, and when he had done he washed himself, and spat repeatedly in the water. He then went away, and within a minute a woman came there, stood almost in the identical spot the old man stood a minute before, and filled two bright brass chatties with the water, and took them home for drinking and cooking. She must of necessity have taken home some of the filth from the old man's clothes and a portion of his spittle to drink and cook with. Now what we have just seen under our eyes was taking place at various times of the day all round this tank, and not only all round this tank, but around the hundreds and thousands of tanks which lie scattered over this fair continent of India.

In Vizianagram I saw a tank, much frequented by the women, who in hundreds might be seen taking home chatties upon chatties of water for domestic purposes, into which no less than eight large drains emptied themselves, and the cattle in numbers were daily washed.

It is needless to go on repeating these examples, they are universal, and I may, perhaps, not be deemed quixotic when I say that with the example of Guntúr before us, and the happy effects of careful water conservancy of late years at all the great fairs and festivals, I see no reason or difficulty why in every municipality and town, and presently in every village, the water for drinking purposes should not be carefully preserved from the frightful contamination which obtains at present.

I believe it would serve a useful purpose and induce the people themselves to assist in keeping their drinking water uncontaminated if at every tank thus set apart an extract from their own Vedas, such as I have quoted above, were legibly printed in the vernacular on a board and exposed in a conspicuous place.

Until this is effected, and as I have pointed out in a recent letter to Government it seems practicable at a comparatively small cost to municipalities and communities, all other sanitary improvements must be carried on in vain. Fairly clean, wholesome, drinking water is a primary necessity for the sanitary welfare of a community.

The Government in reviewing last year's report (1880) observed they were "satisfied with the sanitary progress of the year; but they trust that it may prove to be practicable to secure close sanitary inspection, &c." The remarks of the Army Sanitary Commission have frequently pointed in the same direction; thus in their remarks on the report for 1876 they write: "The facts as a whole lead to the same result as those derived from the villages that the Sanitary Commissioner should have the means placed at his disposal for fulfilling the practical duties of his office. No man, be he ever so zealous, could do much real sanitary work for 29 millions of people. It is quite enough for him to superintend and advise, and he should have the means of doing so placed at his disposal." My predecessor drew attention in 1878 to the fact that whilst in Bombay, a smaller presidency, the Sanitary Commissioner was aided by five

Commissioned Medical Officers employed as Deputy Sanitary Commissioners and Inspector of Vaccination; in Madras there was only one officer at the disposal of the Sanitary Commissioner.

The Sanitary Commissioner with the Government of India draws an unfavourable comparison of the results of vaccination between Madras and Bombay: "The results recorded in last year's annual report showed that in the Madras Presidency only 3·9 per cent. of the estimated births were protected during 1879. During 1880, however, this proportion was nearly doubled, as it is estimated that 6·9 per cent. of the children born during the year were successfully vaccinated." In Bombay he writes: "The work of the special department is supervised by five Deputy Sanitary Commissioners. It is estimated that 37·9 per cent. of the children born during the year were successfully operated upon, and that the ratio of successful vaccination per 1,000 of the population was 25·2." The present Acting Deputy Sanitary Commissioner and Inspector of Vaccination, Dr. Price, writes in a late report after inspecting the north: "With the exception of the Cuddapah District vaccination seems to me to be in a more backward and worse state in the Godáviri, Kistna, and Nellore Districts than in any others I have yet visited. More personal European supervision is evidently required to put it upon anything like a proper footing. According to the present rules the Inspector of Vaccination is expected to visit each district once in two years; long before that time any little good my personal inspection may have done is sure to have evaporated. My opinion is that to be of any real use every Deputy Inspector ought to be able to see each vaccinator under him at least once in three months, and ought to be inspected himself by a European officer at least once in six months."

If closer sanitary inspection is desired, and I am perfectly convinced of its necessity not only as regards purely sanitary matters, but also in regard to vaccination, I would venture to suggest Government be good enough to strengthen my hands by appointing a second Deputy Sanitary Commissioner.

ABSTRACT OF REPORT OF THE SANITARY COMMISSIONER FOR BOMBAY FOR 1881.

(Mr. John Lumsdaine.)

General Population.

It is thought that the report will be more complete if prefaced by a table showing the area of the several registration divisions, and districts, together with the enumerated population for each and its density. Such a table is here appended, and it is proposed to repeat it every year for general reference. It will be seen that by the census taken on the night of the 17th February 1881, the total population of the districts named was 16,454,414, thus made up:—

8,497,718 Males.

7,956,696 Females.

16,454,414

The total area is 123,860 square miles, and the average numbers per square mile are 132·85. The densities range from 15·98 in Thar and Párkar to 35,145·27 in the city of Bombay; but excluding this terribly overcrowded city, and the sparsely peopled Province of Sind, the general average for the other districts is 174·37 persons per square mile.

Table showing for the Districts named, the area, the enumerated population by the Census of 17th February 1881, and the number of persons per square mile.

Divisions.	No.	Registration District.	Area in square miles.	ENUMERATED POPULATION.			Persons per square mile.
				Males.	Females.	Persons.	
NORTHERN DECCAN.	1	Khándesh - - -	9,944	632,468	604,763	1,237,231	124·42
	2	Násik - - -	5,940	397,404	383,802	781,206	131·51
	3	Ahmednagar - - -	6,666	381,602	369,626	751,228	112·69
	4	Poona - - -	5,348	455,101	445,520	900,621	168·40
	5	Sholápur - - -	4,521	294,814	287,673	582,487	128·84
SOUTHERN DECCAN.	6	Sátára - - -	4,988	532,525	529,825	1,062,350	212·98
	7	Belgaum - - -	4,657	434,485	429,529	864,014	185·53
	8	Dhárwár - - -	4,535	442,035	440,872	882,907	194·68
	9	Kaládgi - - -	5,757	317,611	320,882	638,493	110·90
KONKAN.	10	Kánara - - -	3,911	223,005	198,835	421,840	107·85
	11	Ratnágiri - - -	3,922	473,053	524,037	997,090	254·22
	12	Kolába - - -	1,496	191,952	189,697	381,649	255·11
	13	Bombay City - - -	22	464,763	308,433	773,196	35,145·27
	14	Thána - - -	4,243	468,236	440,312	908,548	214·12
GUJARAT.	15	Surat - - -	1,662	306,015	308,183	614,198	369·55
	16	Broach - - -	1,453	168,482	158,448	326,930	225·00
	17	Kaira - - -	1,609	426,781	378,019	804,800	500·18
	18	Panch Maháls - - -	1,613	131,162	124,317	255,479	158·38
	19	Ahmedabad - - -	3,821	439,394	416,930	856,324	224·10
SIND.	20	Karáchi - - -	14,115	265,988	212,700	478,688	33·91
	21	Hyderabad - - -	9,030	407,243	347,381	754,624	83·57
	22	Thar and Párkar - - -	12,729	112,400	90,944	203,344	15·98
	23	Shikárpur - - -	10,001	461,033	391,953	852,986	85·29
	24	Upper Sind Frontier - - -	1,877	70,166	54,015	124,181	66·16

Abstract.

Northern Deccan	-	-	-	32,419	2,161,389	2,091,384	4,252,773	131·18
Southern Deccan	-	-	-	19,937	1,726,656	1,721,108	3,447,764	172·93
Konkan	-	-	-	13,594	1,821,009	1,661,314	3,482,323	256·17
Gujarát	-	-	-	10,158	1,471,834	1,385,897	2,857,731	281·33
Sind	-	-	-	47,752	1,316,830	1,096,993	2,413,823	50·55
The Presidency	-	-	-	123,860	8,497,718	7,956,696	16,454,414	132·85

Note.—This table includes the military population, which is 35,660.

Comparing the numbers of the former census, February 22nd, 1872, with those of the last, February 17th, 1881, it is found that the net increase is neither general nor so large as might have been expected; and the figures alone show, that, during the nine years, there must have been disturbing factors. For the Northern Deccan the increase is 65,917, for the Konkan it is 222,547, for Eastern Gujarát 43,704, for Sind 210,646, and for the Presidency 177,528. For the Southern Deccan there is a net decrease of 365,286.

Vital
statistics.

The number of births registered in 1881 was 459,657, and of these births 239,912 were male and 219,745 were female. In 1880 the registered total was 370,873, and by sexes the numbers were respectively 195,285 and 175,588. For the nine years, from 1872 to 1880 inclusive, the mean annual registered total is 310,004; thus made up of 163,194 males and 146,810 females. The total for 1881 is higher by 88,784 than that for 1880, and it exceeds by 149,653 the mean annual total for the last nine years; it is presumptive proof of improved registration. The general birth-rate for the year was 27·93 per 1,000 of population. For male births it was 28·23, and for female 27·62. In 1880 the general birth-rate was 22·85. For males it was 23·02 and for females 22·67; the general annual mean for the last nine years is 19·10 per 1,000 of population. It will be seen that the general birth-rate for 1881 is higher by 5·08 than that for 1880, and it exceeds by 8·83 the mean rate for the past nine years. The proportion of male to female children born was 109·18 to 100; last year it was 111·22, and the mean annual total for the last nine years was 111·16. In every 100 births there were 52·19 males and 47·81 females, and for every 100 males there were 91·59 females. In 1880 there were 89·91 females for every 100 males and the annual mean for the last nine years was 89·96. The ratio of boys born alive has again exceeded that of girls.

In each division and district the number of births recorded was in excess of the annual mean for the preceding 9 years. But taking the number registered for each district in each year from 1872 to 1880, and comparing it with that for 1881, it will be seen, that in 3 out of 24 districts, the number for 1881 was lower. In Ahmednagar the number registered in 1876 was 24,427 against 24,313 in 1881. In Ratnágiri, in 1875 and 1876, it was 16,473 and 16,451 respectively against 16,200. In Bombay City in 1880 it was 16,997 against 16,381.

In 22 out of the 24 districts the mean annual birth-rate for the 9 years ending with 1880 was below the mean annual death-rate for the same period. In 1881 the birth-rates were lower than the death-rates in Bombay City, Broach, Ahmedabad, Karáchi, and Hyderabad, in all other districts they are higher. At Sátára they were respectively 35·14 and 21·35, at Belgaum 35·90 and 23·30, at Dhárwár 37·73 and 23·20, in the Panch Mahals 40·03 and 17·43, and at Thar and Párkar 27·01 and 16·98. For the Presidency the birth and the death-rates were respectively 27·93 and 23·18: only twice—in 1874 and 1880—has the birth-rate exceeded the death-rate.

Amongst the civil population, the total of deaths recorded in 1881 was 381,450. By sexes there were 202,166 of males and 179,284 of females. In 1880 the registered number was 328,673, and the mean annual number for 9 years ending with 1880 was 395,281. The computed death-rate per 1,000 of population was 23·18, and for 1880 it was 20·25. For the 9 years ending with 1880 the average was 24·35, so for 1881 it was higher by 2·93 than for 1880, but less by 1·17 than the mean for the preceding 9 years.

The death-rates by districts per 1,000 of population ranged from 37·91 in Broach to 6·56 in the Upper Sind Frontier. In 1880 the maximum ratio (32·39) was in Bombay City, and the minimum (6·95) in the Upper Sind Frontier. In 1881 the greatest number of deaths (30,661) occurred in the Khándesh district, and the least number (815) in the Upper Sind Frontier. In 1880 the extremes were at Ahmedabad and the Upper Sind Frontier—24,539 and 625.

The results of deaths at different stages of life, for 1881, as compared with 1880, show a marked increase in the number recorded under each. Taking the mean mortality for the past 7 years, there was a remarkable decline in the number this year in each stage of life, except for infants unable to walk. For these in 1881 the ratio is 164·69 against 94·55 in 1880. For old people over 50 it is 45·25 against 60·80. Taking the percentage on total deaths, the highest (36·30) is amongst adults, and the lowest (19·76) amongst infants.

The following table shows deaths from specified causes for each year from 1872 to 1880, and the annual mean for this period is contrasted with the total for 1881:—

YEARS.	DEATHS BY CAUSES.						
	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Injuries.	All other causes.	All causes.
1872	15,642	26,699	206,747	33,664	5,804	67,404	355,960
1873	283	9,935	188,201	26,259	5,951	60,343	290,972
1874	37	3,903	183,717	26,990	6,165	57,840	278,652
1875	47,555	3,461	219,156	33,650	6,217	65,679	375,718
1876	32,117	11,817	220,833	33,683	5,928	63,882	368,260
1877	57,252	27,369	336,865	60,257	7,539	138,426	627,708
1878	46,743	4,475	357,376	41,165	7,550	75,642	532,951
1879	6,937	1,156	286,526	26,349	7,107	59,467	387,542
1880	684	940	246,779	24,452	6,082	49,736	328,673
Total	207,250	89,755	2,246,200	306,469	58,343	638,419	3,546,436
Mean for nine years	23,028	9,973	249,578	34,052	6,482	70,935	394,048
Ratio per 1,000 of population enumerated at the Census of 1872	1.42	0.61	15.38	2.10	0.40	4.37	24.28
1881	16,694	539	272,403	30,342	5,950	55,522	381,450
Ratio per 1,000 of population enumerated at the Census of 1881	1.01	0.03	16.56	1.84	0.36	3.38	23.18

N.B.—In the Shikápur District the total of deaths in 1872 was 11,097; the cause details were so imperfect that they are not included in the total for that year.

Before speaking of the cholera mortality of 1881, it may be noted that the results tend to bear out the triennial wave theory hinted at in former reports. The subjoined table shows year by year for the period indicated, and for each division, the registered deaths from cholera, and the totals for the 16th year are so placed, as to contrast with the means of the previous 15 years. Cholera.

Divisions.	Population by Census of 1881.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	Total for 15 years.	Means for 15 years.	1881.
Northern Deccan	4,252,773	2,872	180	3,820	8,171	719	3,971	10,383	—	2	22,151	4,431	11,444	15,890	578	530	85,150	5,077	10,001
Southern Deccan	3,447,744	18,184	90	1,343	23,782	934	338	4,031	123	1	10,035	19,052	30,982	15,183	—	18	124,075	8,272	1,358
Konkan	3,462,323	1,474	327	921	3,430	858	1,457	711	107	19	9,203	2,272	12,900	4,304	1,236	127	39,490	2,633	2,233
Gujarat	2,537,731	488	196	241	9,426	156	55	517	53	15	6,008	6,274	1,946	11,270	920	9	37,663	2,511	3,102
Sind	2,413,823	4,360	23	7,513	—	—	—	—	—	—	48	88	—	20	4,140	—	16,197	1,079	—
Total	16,454,414	23,027	5,143	6,347	52,330	1,666	5,821	15,642	283	37	47,555	32,117	57,252	46,743	6,937	684	302,584	20,172	16,694

It will be seen that for the 15 years period, from 1866 to 1880 inclusive, 302,584 deaths were registered from cholera, and this would give an annual rate of 20,172. With an equable rate, and with the grand total of the last census, out of every 816 persons living *one* died of cholera. Looking at the last line of the table it will be seen, that for 10 years the triennial recurrence is unbroken: in the 11th and 12th years the famine was a disturbing factor, and the high number for the 13th year marks it as a recurrent year. The total then falls from 46,743 to 6,937, and in the next year to 684: in the next, however—the 16th—the wave returns, and the deaths are 16,694.

Of our 285 registration circles, 144 were affected, and the total mortality was 16,694. These deaths were distributed over 18 districts or collectorates, and 1,563 units of registration. The ratio per 1,000 of cholera deaths to the population of the Presidency was 1.01. Out of the 223 rural circles, 55 town circles and 7 civil cantonment circles, 115, 25 and 4 were respectively affected. Out of 24,535 inhabited villages, 1,534 were affected.

All the five districts in the Northern Deccan Division were affected, and the attacks and deaths were 22,056 and 10,001, against 705 and 530, in the preceding year. In the Southern Deccan, it prevailed more or less in all four districts and in this division, the attacks and deaths were 3,239 and 1,358 respectively, against 42 and 18. In the Konkan Division, it also appeared in all the five districts, and the attacks and deaths were 3,576 and 2,233, against 199 and 127 in 1880. In Gujarát, 4, out of the 5 districts, were affected, and the attacks and deaths were 6,011 and 3,102 respectively, the figures for the preceding year being only 25 and 9, but had it not been for the Surat District, which alone contributed 5,388 attacks and 2,751 deaths, the cases for the division would have been very few. The Panch Maháls District of this division was exempt during the year. There was only one case reported from the Shikápur District of the Sind Division, and it recovered. The rest of the Sind districts were exempt during the year as well as in the previous year.

Small-pox.

In 1881 the registered deaths from small-pox were 539, and shown by sexes there were 301 of males and 238 of females; the mean annual number for the last nine years is 9,973. Out of the 24 districts seven were exempt, in nine the deaths were below 10, and in the remaining eight Shikárpur stands first with a maximum of 202. Next was Karáchi with 102 deaths, Hyderabad with 55, Kolába with 49, Bombay City with 37, Upper Sind Frontier with 28, Ratnágiri with 19 and Thána with 16. By divisions Sind headed the list with 391 deaths, the Kónkan following with 122, and Gujarát, and the Northern and Southern Deccan with 12, 10 and 4 respectively.

The following table shows the deaths for each month, those under one year, under 12, and above 12, and it will be seen from it that the minimum mortality was amongst infants under one year and the maximum amongst those above 12 years:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Total deaths from small-pox in each month	26	65	79	89	81	86	37	28	13	12	5	18	539
Deaths under 1 year - - -	4	12	16	22	20	26	7	9	5	4	1	6	132
Do. do. 12 years - - -	2	21	26	33	34	31	12	15	5	3	3	9	194
Do. above 12 years - - -	20	32	37	34	27	29	18	4	3	5	1	3	213

Fever.

The deaths from fever in 1881 were 272,403 against 246,779 last year, and by sexes there were 143,929 of males, and 128,474 of females; this shows an increase of 25,624 deaths during the year.

In the Northern Deccan, Gujarát and Sind Divisions there was an increase of 32,257 deaths over those of last year, whilst there was a decrease of 6,633 in the Konkan and the Southern Deccan Divisions. For the Presidency the total increase for the year was 25,624. With the exception of the Belgaum, Dhárwár, Kaládgi and Ratnágiri Districts, and Bombay City, there was an increase, more or less, in each district over that of last year. The highest ratio of mortality during the year was 33·14 in Broach, and the lowest was 5·37 in the Upper Sind Frontier. By divisions the maximum mortality (25·62) was in Gujarát and the minimum (11·42) in Sind.

Bowel complaints.

The deaths from bowel-complaints during the year under report were 30,342 against 24,452 last year, showing therefore an increase of 5,890. By sexes, there were 16,842 of males, and 13,500 of females.

Except in the Sind Division there was an increase in the number of deaths from bowel-complaints during the year under report, but compared with the mean of the nine previous years there was a decrease for the Presidency of 3,710, and when compared with the number of 1880 there was an increase in each district except in Kánara, Kolába, Panch Máhals, Hyderabad and Thar and Párkar. The highest ratio 3·68 per 1,000 during the year was in Khándesh, and the lowest 0·03 was in Thar and Párkar.

Vaccination.

The following table contrasts the work amongst the civil and military population during the year under report with that for 1880-81:—

Establishment.	Persons primarily vaccinated.				Persons re-vaccinated.				Total number of Persons operated on.			
	1880-81.	1881-82.	Increase.	Decrease.	1880-81.	1881-82.	Increase.	Decrease.	1880-81.	1881-82.	Increase.	Decrease.
IN CIVIL LIFE.												
Itinerant . . .	615,559	696,109	{ 8,250 13·41 }	—	54,557	51,320	{ — 5·93 }	3,237	670,116	749,429	{ 79,313 11·84 }	—
Dispensary . . .	22,732	26,813	{ 4,081 17·96 }	—	2,479	2,405	{ 16 0·65 }	—	25,211	29,308	{ 4,097 16·25 }	—
Total . . .	638,291	724,922	{ 86,631 13·57 }	—	57,036	53,815	{ 16 0·03 }	3,237	695,327	778,737	{ 83,410 12·00 }	—
IN ARMY LIFE.												
Native Army . . .	3,555	3,830	{ 275 7·74 }	—	2,837	1,917	{ — 32·43 }	920	6,392	5,747	{ — 10·00 }	645
British Army . . .	659	571	{ — 13·26 }	88	2,606	1,037	{ — 60·21 }	1,569	3,265	1,608	{ — 50·75 }	1,657
Total . . .	4,214	4,401	{ 275 6·53 }	88	5,443	2,954	{ — 45·73 }	2,489	9,657	7,355	{ — 23·84 }	2,302
Total for the whole Presidency.	642,505	729,323	{ 86,806 13·52 }	88	62,479	56,769	{ 16 0·02 }	5,726	704,984	786,092	{ 81,108 11·53 }	2,302

It will be observed that there were 729,323 persons primarily vaccinated, and 56,769 re-vaccinated, against 642,505 and 62,479 in 1880-81; showing a net increase of 86,818,

or 13·51 per cent., under primary vaccinations, and a net decrease of 5,710, or 9·14 per cent., under re-vaccinations. There was a considerable decrease (5,726 persons) under re-vaccinations amongst Native and European troops and the itinerant establishments, the figures being 54,274 against 60,000 in the preceding year. The rate of increase in re-vaccinations was only 0·65 per cent. in the work of dispensaries. On the whole, there has been an increase of 81,108, or, in other words, for every 100 persons operated on in 1880-81 the numbers for this year have been 111·50.

Out of 729,323 persons primarily vaccinated, 703,923 cases were successful, or 96·52, the highest percentage ever attained, against 95·95 in 1880-81, 95·11 in 1879-80, and 94·53 in 1878-79; thus showing that there was an improvement in the quality and the quantity of the work performed during the year. The number of unsuccessful cases also compares favourably with those of the previous years, being 14,061 against 14,721, 15,178, and 19,425. Secondary operations, after the failure of the first, were performed on 2,701 persons, and 14,040 persons escaped observation.

During the year 56,769 persons were re-vaccinated, against 62,479 for 1880-81. In 162 instances the re-vaccinations were repeated; in 6,091 instances the results could not be ascertained; and in 10,165 it failed. The number of successful cases was 40,675 or 71·65 per 100, against 72·79 in the preceding year.

The total number of persons operated on were 786,092 and of these 744,598, or 94·72 per cent., were successful. In 1880-81 the percentage was 93·90. There were 2,863 persons operated on more than once; the "unsuccessful" numbered 24,226, and the "unknown" cases were 20,131.

The age details are compiled for three stages, viz. those under one year, those between one and six years, and those above six years. The numbers under each stage primarily vaccinated were respectively 479,000, 231,352 and 18,971 against 396,618, 223,988 and 21,899 during the preceding year. The number of infants successfully vaccinated was 463,311, of children between one and six years 223,313, and of persons of other ages 17,299. Thus out of every 100 persons primarily vaccinated there were 65·68 infants, of whom 63·53 were successfully vaccinated against 59·58 in 1880-81, 52·71 in 1879-80, 52·11 in 1878-79, 47·55 in 1877-78, and 42·18 in 1876-77. Thus every year is characterised by a progress in the protection afforded to infants.

Animal vaccination was carried on in Bombay and Poona. In Karáchi it has been discontinued since last year.

In Poona 35 out of 39 heifers were successfully inoculated. Their cost was Rs. 133-3-6 against Rs. 184-10-3 last year. In Bombay 434 heifers were inoculated against 406 during the preceding year. On 34 heifers the operations proved unsuccessful. Three calves were inoculated successfully out of 13 with the Brussels cow-lymph received from Dr. Warlomont. The total cost was Rs. 3,146-5-10, whilst last year it was Rs. 2,505-4-3. As the lymph showed a great tendency to degenerate in the calves inoculated during the months of August, September, October, December, and January, animal lymph was also obtained from the animal vaccine establishment at Manningtree, England, at exorbitant rates, but all the supplies failed. However, the lymph from Brussels succeeded in three calves, and so it was re-established. Animal lymph was sent to Tasmania, New South Wales, China, and the Civil Surgeon at Surat.

Except in Bombay, where animal lymph only is kept up, and in Poona where both animal and human lymph were in use, vaccination in all other places was carried on from arm to arm and with human lymph. On the whole, the number of heifers inoculated was 473, and in 38 it failed; the total cost was Rs. 3,279-9-4.

The total cost for the whole Presidency, including all charges, was Rs. 2,60,355-14-2, and the successful cases, excluding dispensaries and the army, were 712,475. The average cost per each successful case was annas 5-10 or 2 pies less than last year.

Taking the work of all the Deputy Sanitary Commissioners, Superintendents, Assistant Superintendents, and Inspectors together, there were 5,289 encampments; 88,941½ miles travelled in 9,218 days; and 343,652 children inspected in 14,762 villages. Out of every 100 persons operated on, 43·72 were this year inspected against 46·27 in the preceding year, 43·10 in 1879-80, 45·58 in 1878-79, and 35·53 in 1877-78.

The Compulsory Vaccination Act (I. of 1877) has been in force for four years, and continues to work fairly well.

This is the second complete year in which the Karáchi Vaccination Act (No. IV. of 1879) has been worked in that city, and although there was a decrease in the quantity (the number of operations having fallen from 5,629 in 1880-81 to 4,655) owing to many unprotected children above one year of age having been operated on in 1880-81, great improvement has been effected in the quality of the work performed over that of the last year.

Sanitary Works.

Military works. The actual outlay on sanitary works (military) during 1881, amounted to Rs. 4,22,109; of this sum, Rs. 2,43,103 were spent at Nasirabad, of which Rs. 2,43,061 were for supplying water from the Danta reservoir. At Aden Rs. 39,952 were expended on the construction of lines for a company of sappers and miners, quarters for the engineer in charge, Leera condenser, and some minor works. At several other military cantonments smaller sums were spent on sanitary works.

Civil works. The original reports received from municipalities are exceedingly valuable, but they are far too lengthy to be published *in extenso*. They have been abstracted and the results are given in the report.

The total annual income of the various municipalities was Rs. 25,69,791, and the sum expended on conservancy by them during the year 1880-81 was Rs. 6,33,713.

General Remarks.

The following are some of the points of special interest connected with the inspections made during the year.

Thána Water-supply.—In July 1880 a water-supply scheme for the town of Thána, planned by Mr. Maclaren, C.E., was sanctioned, and water was supplied in July 1881. The storage reservoir is N.W. of the town, distant about 2 miles. The water is impounded by an earthen dam 1,005 feet in length and $31\frac{1}{2}$ feet maximum height, the level of the waste weir being $6\frac{1}{2}$ feet, and of highest flood level 5 feet below the top of the dam. The surface area at level of waste weir sill is 489,400 square feet and the total cubic capacity at that level is 4,304,320 cubic feet, equal to 27 million gallons. The outlet is by means of a masonry tower provided with valves at every 5 feet in height, the pipe from which, 10 inches in diameter, passes below the dam in a trench cut into the solid rock, and filled in with concrete. The cast-iron main to the town is 7 inches in diameter and 10,365 feet in length, having a fall from the reservoir to the town of 108 feet. At the town end of the main is a valve, and meter-house where the quantity of water daily passing into the town is measured, registered and controlled. The distribution is by cast-iron pipes of suitable sizes to hydrants situated in different parts of the town. There are in all 16 hydrants with 67 taps, all of which are self-closing to prevent waste. The storage reservoir is calculated to hold sufficient water, after deducting loss by evaporation, &c., to give a supply of $5\frac{1}{2}$ gallons per head of population, taken at 15,000, the numbers by the last census being 14,456. To this amount may be added the yield of a spring in the reservoir which has been gauged at 37,500 gallons in 24 hours, making the total available supply 8 gallons per head per diem. The total cost of the works has been Rs. 84,630, provided partly from municipal and partly from the Thána District local funds. The value of the supply will be appreciated when it is remembered that the majority of the tanks and wells were more than ordinarily impure, and were said to give rise to guinea-worm—in fact the well in the Collector's compound was about the only good one. In addition to the improved water-supply, improved markets are being constructed, and the municipality are now reclaiming with town sweepings a considerable area which was under tidal influence.

Pandharpur Water-supply.—This water-supply has caused much correspondence, and no little anxiety, by its quality having become somewhat suddenly impaired. This led to a thorough inspection of the entire system, the catchment area has received special attention, and not only has it been enlarged, but arrangements have been made for filtration. The original project was drawn up by Major Penny, R.E., in 1868, and he, together with Mr. Whiting and Mr. Burke were respectively employed in the construction of the works. By the last census the population of the town is 16,917 persons, but the temple of Vitoba is one of the great centres of pilgrimage, and the visitors or pilgrims often exceed 100,000. The average total rainfall is 26 inches, and the average monsoon fall is 24 inches. In preparing the scheme the minimum rainfall was assumed at 13 inches, and the record of 19 years shows that in two only, which were exceptional, it was less than 13; the range has been from 6.84 to 36.69. The quantity of rainfall flowing off the catchment area of 10 square miles was gauged from the 12th to the 15th September last, and, within those dates, the rainfall being 6.75 inches, the amount on the catchment area is 156,816,000 cubic feet; of this amount 46,742,542 cubic feet or 0.297 flowed into the tank.

In preparing the original scheme one-fourth of an exceptionally small rainfall of 13 inches was assumed as at least available, that is $\frac{13}{4} = 3\frac{1}{4}$ inches, which yields 43,037,280 cubic feet, and making all allowance for loss by evaporation and absorption, &c., would yield a quantity considerably in excess of the annual demand estimated at 10 gallons per head per diem for 25,000 persons. The catchment area of the tank was originally only 5.70 square miles, but this experience proved to be insufficient, as in years of small rainfall, when the falls occurred at long intervals, or falling in light showers rather than heavy falls, the tank did not fill. Works were therefore undertaken in 1877 by which the area was increased to 10 square miles, and this has proved to be sufficient. The area of the tank as now existing is at the level of the sill of the outlet sluice, or regulator, at reduced level 160 feet above datum, and 1,477.60 feet above "mean sea-level" = 2,032,795 square feet, or $46\frac{1}{2}$ acres; and the area at the level of the "full supply" at reduced level 178.00 = 8,537,700 square feet, or about 196 acres.

The total capacity of the tank = 89,330,058 cubic feet.

Deduct capacity of "bottom"

or that below the level of

the sill of the regulator - 10,163,975 „

Available capacity - 79,166,083 „

In preparing the scheme it was assumed that it would be necessary to provide for the daily supply of 25,000 people, allowing 10 gallons per head, that is, the total daily demand was estimated at 250,000 gallons, and the annual at 91,250,000 gallons. Regarding the actual quantity of water used, there is a difficulty in reducing this to a rate of expenditure per head, owing to the variable nature of the population. There is invariably a certain number of pilgrims at Pandharpur, sometimes only a few, and at others, during great fairs, a great many, and as it is impossible to obtain even an approximation to this variable number, it has been thought best to calculate the expenditure per head on the resident population or 16,917 inhabitants, according to the latest census. Adopting this the maximum and minimum rate of expenditure per head of fixed population were as follows:—

		Maximum per head.	Minimum per head.
1879	- - -	9.28 gallons.	7.20 gallons.
1880	- - -	9.37 „	6.48 „

In December and January last, when there were very few pilgrims at Pandharpur, experiments were made to determine the hourly rate of consumption. The results gave 115,000 gallons as the total for the day of 24 hours, and 6.79 gallons as the average quantity per head for 16,917 persons. The distribution in the town and environs is by means of 38 stand posts, some fitted with 4, some with 2, and others with 1 tap. There are also 3 iron cisterns fitted with 16 taps. These have been fixed where a larger demand prevails, but on the whole are inferior to the stand posts. Lambert's patent push-cocks have been found to be the most satisfactory in every way; they are simple in construction and action, admit of ready repairs, and allow practically no waste of water. The enlargement of the catchment area necessitated the construction of a weir across the Casegaon nála, a catch-water canal nearly 6 miles in length provided with suitable cross drainage works, and a silt trap at the tail: the results have been highly satisfactory. A system of filter beds has been arranged in the service reservoir which will satisfy immediate requirements, and can be used during the construction of larger and more permanent works should such be found necessary.

Before the supply was given there was hardly one single well in the town or suburbs of which the water could be said to be fit for drinking, and there was not one in which it could have been classed as good. The sacred character of the place necessarily fosters an intensity of prejudice, and at every pilgrim gathering numbers think it incumbent on them to take an unwholesome supply from the stream sacred, but polluted in every way it can be polluted. Notwithstanding this the supply is an immense boon, and it is very thoroughly appreciated.

In addition to water-supply there is a proposal for improving the drainage, and for erecting shelter sheds for 20,000 pilgrims. The general conservancy of the town is very fairly looked after.

Nasirabad.—In the memorandum by the Army Sanitary Commission on the health of British Troops during 1879, attention was called to the prevalence of enteric fever at

this station; and it was suggested that the question should be entrusted to me for inquiry and report. A special inspection of the cantonment was made in November last, and I may as well say at once, that there were absolutely no insanitary conditions, and no apparent causes to which the past sickness could be assigned. At the time of my visit the annual reliefs, and the expected arrival of the Viceroy at Ajmere had almost entirely denuded the place of its usual garrison. The barracks were barely occupied, and the lines were comparatively deserted.

The well water within the station is more or less brackish, but the drinking water for the troops is carted in from Dilwarra, a village some two miles distant. The well from which it is drawn is lined, and has a raised platform, the greater part of which is reserved for Government use. Seeing that this well always has been, and always will be a source of supply, it is strange that more care has not been taken of it. It borders a public road, and is uncovered. It is seemingly below the level of the village, and there is cultivation close up to it. For the troops it is drawn by mule, and an iron carrier pipe takes it to the road side at a sufficient height to let carts draw up under a filling hose. The villagers draw at will, and with their own ropes and vessels. Before my visit it had been cleaned out, and several cart-loads of black mud were removed. There was no available record of former cleaning.

A sample from the well itself was classed as bad; and the presence of such advanced organisms as rotifers, and the fact that there were 0·14 parts per million of albuminoid ammonia left no choice. The effect of thorough filtration in three samples from three hospital filters showed that the total solids were lowered from 28 to 25·9 and 25·6, the chlorine from 3·5 to 3·1 and 3, the free ammonia from ·02 to ·01 and ·005, the albuminoid ammonia from ·14 to ·06, ·04, and ·03, and the sediment, which contained *rotifers*, was all removed. The absence of organisms in the filtered sample may be taken as indicating that the conditions which produced them had disappeared; and similarly their presence in the well sample showed that, in the well, those conditions were still in force.

It is very evident, that, at the well, matters are not as they should be; and it is equally clear that something should be done to improve them. Covering it in will exclude once chance of accidental impurity, and another may be got rid of by preventing any cultivation on ground at a higher level within a certain radius, say 50 yards. The present mule should be dispensed with, and a lift and force pump substituted. This might be fitted alongside the well, and not over it so as to avoid any droppings of oil or grease. The water is only some 30 or 40 feet from the surface, and with a good lift the delivery might be at a point much near to camp, with a cistern sufficiently raised it might possibly be somewhere in camp. As each trip is one of four miles, the wear and tear of carriage, gear, and animals is worth consideration. One or more cisterns would have to be provided for the villagers to whom the well would then be closed, but as long as they got their supply without prejudice to caste scruples the mere deprivation of drawing it would be no hardship. I have suggested a lift and force pump, but of course if the fuel could be provided steam power would be preferable.

Another proposed source of supply is the Danta Lake, a newly constructed reservoir some 6 miles distant from which the water is brought by gravitation. It would be premature to express an opinion as to its future, but whether it be that the catchment area is insufficient, or whether the rainfall is too precarious, or the leakage too great, there is a floating suspicion that the supply is not all that was hoped for. The analysis was unfavourable, but the first examination of a new impounding reservoir is generally so. It showed total solids 15·4 grains per gallon; chlorine 4·2 grains per gallon; free ammonia 0·10 parts per million, and albuminoid ammonia 0·24. There are excellent filtering arrangements, but unfortunately they are at the wrong end of the main, and the consequent loss of head is seen at hydrants and taps. It is doubtful whether the supply can be extended to the bázár, and it will be a grievous disappointment if it cannot, but there is talk of forming another reservoir, and connecting it with that at Danta to supplement it.

The Diggy Tank water is unmistakeably, and absolutely bad, but necessity compels its use in the bázár. The analysis of the wells shows what would be the condition were they chief sources of supply.

Sholápur Water-supply.—The town is now supplied by gravitation. The water is taken from the Ekrúk perennial canal at the 4th mile, and is first passed into a settling tank. It is then led to a well in the engine-house from which it is pumped into two reservoirs, at different levels. The supply is 5 gallons per head per diem for 50,666 persons. The distribution is by pipes, and hydrants, the quality is good, and all the arrangements are everywhere excellent.

Karáchi Water-supply.—Upwards of 20 years have passed since the feasibility of obtaining a water-supply from the Mulir river was first put forward; and at last, after interminable delays, the scheme has assumed a definite shape, and the works are approaching completion. In a bee line the head-works are $15\frac{1}{2}$ miles east of the Somerset Barracks, but the length of the conduit is about 18 miles. There are two wells each 40 feet in diameter, within each of which is a cast-iron valve shaft with three 24 inch slide, or regulating valves placed at different heights working on it. The main delivery valve is also connected with the bottom of the shaft. All these valves are worked from a platform at the top of the well above ground level. From the main delivery valve for a distance of over a mile and a quarter a 24" cast-iron pipe is to be laid. At the end of the pipe the masonry conduit commences. This is built of rubble masonry, and has a sectional area of 5 feet 6 inches, with a minimum fall of 3' 9" to the mile.

The capacity of discharge of the conduit is thus over 6 million gallons per diem. Flat cover stones with concrete on the top close in the conduit which is lined with Portland cement $\frac{1}{2}$ -inch thick. This conduit extends for the whole distance (16 miles) between the end of the 24-inch pipe before mentioned, and the distributing reservoir at Karáchi, except where it has to dip under the Thudda river and smaller nálas, and at these points syphons either of masonry, or of cast iron, are erected. The conduit discharges into an inlet well alongside the distribution reservoir: this well is 20 feet in diameter, and is built of ashlar set in concrete.

The distributing reservoir is 200' \times 150', and will contain a depth of water of 11 feet, the total capacity being equal to 2,000,000 gallons. The reservoir and inlet well are connected by a 24-inch pipe, but communication between them can be cut off, when it is considered desirable to do so, by means of a sluice valve in the well. Both the reservoir, and the inlet well are provided with cleansing pipes taken off at 2 feet below the level of the main delivery pipe. The main delivery pipe has a branch into both the reservoir and the inlet well each branch, finishing with a 24-inch sluice valve. By this means the supply to the town can be taken direct from the inlet well without reference to the water in the reservoir. The main delivery pipe diminishes a little way from the reservoir to a 12-inch pipe, but it is hoped that this will be but a temporary measure, and that soon the 24-inch main will be laid into camp as originally proposed. The mains and sub-mains, and distributing pipes in the camp and city are of the ordinary description. At intervals where convenient at all the streets where the mains are laid, stand pipes, bullock and street services are to be erected.

The quantity of water provided for in the full scheme is 25 gallons per head per diem for 80,000 persons; but the present main can supply, for the same number, only 8 gallons. The quantity of water at present being discharged to waste from the pipe trench amounts to 1,800,000 gallons per day. As the excavation is still 1,000 feet from the site of the wells, and the wells themselves only excavated to water level, a very great increase on this quantity will yet be obtained. The discharge of water from the pipe trench has been steadily increasing since April 1881 when water was first tapped.

From this description it will be seen that the amount run to waste exceeds the estimated amount required, so the supply has been subjected to a most crucial test, and has not been affected by it. The quality seems to be all that can be desired, and after the brackish water now supplied, it will be most welcome. I had hoped to have obtained analyses of it, and of all the Sind waters, but the arrangements fell through; and they cannot be resumed until the cold season.

Sanitary condition of the town of Násik.—Násik, the chief town in the collectorate of the same name and the head-quarter station of the Collector, is situated in latitude 20° N. and longitude 73° 51' E. on the table-land of the Deccan at an elevation in the higher parts of the town of 1,943 feet above the level of the sea from which it is distant as the crow flies 64 miles. The town has been built on the elevated ground sloping down to the river Godávari which a few miles above it splits up into several streams, which receive the drainage of the eastern spurs of a portion of the Sahyádri range and thus form the head waters of the river, but the best known and the most highly venerated source from which the sacred river springs is at Trimbak, about 19 miles to the south-west of Násik.

The country round Násik is somewhat bare and destitute of vegetation, though the situation of distant villages is marked by clumps of trees, but the immediate neighbourhood of the town is well-wooded and highly cultivated ground is found after crossing the river Nasardi, an affluent on the right bank of the Godávari and fine mango topes, with

burr, pipal, tamarind, and other trees afford a grateful shade to wayfarers and cattle, whilst the more distant landscape is on the south extending round to the west, rendered extremely picturesque by the ranges of hills which approach Násik within $4\frac{1}{2}$ or 5 miles among which the cone-shaped hill of the sacred Pandao Lena with its far famed chaitrya caves, commenced according to Fergusson in 129 B.C., and the Chincola hills stand out prominently in the foreground, whilst at a distance of about 16 miles the flat-topped mountain of Unjinira rises to a height of about 4,300 feet above the level of the sea, near the summit of which there are bungalows which form a valuable health resort for residents in Khándesh and Nasik during the hot season. The Thul Ghát, down which the road to Bombay descends, is 28 miles distant in a straight line on the south-west, but the nearest point of the Sahyádrí range is at Oonbar Ghát, only 15 miles away on the west. On the north extending round to the west are seen the funnel-shaped hill of Chambar Lena, the sacred hill and fort of Rámsej, the rugged outline of Bawaghur and the peak of Gírnara.

The rock round Násik consists for the most part of black cotton soil or the disintegrated covering of the subjacent trap. This retains moisture to a large extent and is the source of much of the water which is carried off by the Nasardi river, which, rising among the hills to the south-west receives the drainage of the plain through which it flows. Its bed, in which water even during the hottest months of the year is always found, is at a considerably higher level than the town above which it passes until it joins the Godávári about $1\frac{1}{2}$ miles below Násik.

The prevailing wind is westerly, and observations taken during the last seven years at the Civil Hospital, show that on the average it blew for upwards of 10 months in the year from the westward of north and south, and that for only one month in the year it blew from north-east-east or south-east.

The climate of Násik is very healthy and pleasant, and even in the hot season during the month of May the nights are cool and refreshing, although the wind during the day absorbs heat in passing across the plain.

Násik has been inhabited by man from the earliest ages. In fact its history is lost in fabulous antiquity. According to the Shastras the town was originally called Pudina Nagar, the Lotus city, but in course of ages this name was changed to Tritruntak, the city of the three giants who, in the old legends, are said to have ravaged the country until they were at last providentially killed. Again, the name of the city was changed to Janasthan the place of many people, but in historical times it has been called by its present name (Násik) the nose, the derivation of which is very uncertain, for whilst some attribute it to the sacredness of the town being worthy as it were to form the nose of the head of India, others have connected it with the exploits of Laxuman, the favourite brother of Rama, who is said to have cut off the nose of Soorp Nakha, the sister of Ravan, at Bhrama Yoni, (2) circular holes in the river bed near Tapovan, a short distance below the town. Others consider that the town obtained its name from the configuration of the hill on the south-east now known as Juna Guree.

The present town appears to have grown piecemeal and must present a very different aspect to what it formerly did. The part that has probably least altered is Punchvati, so-called from the five-burr (vad) trees overshadowing Sita Gumfa or cave from which it is believed by the faithful a subterranean passage leads to the hill of Rámsej (Rama's couch), eight miles away. It is situated on the rising ground on the north or left bank of the river, and extends along it between the Aruna nála on the west and the Vuruna or Wagadi nála on the east, and has probably from the many sacred associations connected with it been always considered the centre of religious attraction by devotees from all parts of India. The old city of Násik was situated further down on the opposite or south bank of the river and was said to stand on ten teks or hills. On the east it was bounded by the Nagjeri nála which discharges itself into the river below the causeway near the present Talkote's temple, and it probably extended on the west as far as the Sarasvati nála which is the principal watercourse of Násik and which discharges itself into the river at Ballaji's temple opposite Punchvati. Some of the Hindu names of these teks have been lost, and these are now known by the designations given them under Mahomedan rule.

The municipality of Násik was constituted a town municipality in 1874. The inhabited area is estimated to cover about 462 acres, but this estimate appears to me to be rather a low one. For municipal purposes the town is divided into three sections, Kusba, Pura and Panchvati, but the Public Health Department has added a fourth by subdividing the kusba into Kusba and Kazipura. There are estimated to be 27 miles of thoroughfare, but there are only nine miles of metalled roads. The streets in the hilly parts of the town are in places too steep for wheeled vehicles, they are extremely narrow

and are for the most part paved with roughly hewn stones, an arrangement which is evidently necessary to prevent the surface being washed away during heavy rain.

The European quarter of the town is situated on the west of Návapura and is well exposed to the westerly breeze. There are, however, some old quarries near the bungalows which are filled with water during the rains and during the process of drying up must be the cause of malaria, especially as they are the resort of the dhobies during the monsoon.

Násik is a Bráhmínical town, and I learn that there are 1,300 houses occupied by priests. There is a pilgrimage held here every year called the Rámnávmi, which lasts for four or five days in the month of April, when upwards of 10,000 pilgrims visit the town. Every 12th year is still more sacred, and then about 15,000 pilgrims collect. The dharmshálás in the town are not sufficiently large to accommodate such vast numbers, and every year the river bank and Panchvati are crowded with pilgrims who in great numbers live in the open air, in the court-yards of the temples, &c.

The population of the town at the census of 1872 was 22,436, of whom 11,771 or 52·46 per cent. of the total were males and 10,665 or 47·54 per cent. females. The tables of the census of 1881 are not available as they have been sent to Poona for compilation, but at it 23,536 persons were enumerated, showing an increase in the last nine years of 1,100 persons or rather more than five per cent.

The chief source of drinking water-supply of Násik is the river Godávári, and the analysis made by Assistant Surgeon De Souza, the travelling water analyst attached to the Sanitary Department, proves how impure the water of the Godávári is and how entirely unsuited it is for a drinking-water supply. Wanklyn, the great authority on water analysis, says:—"If a water yield ·00 parts of albuminoid ammonia per million it may be passed as organically pure despite of much free ammonia and chlorides; and if indeed the albuminoid ammonia amounts to ·02 or less than ·05 parts per million the water belongs to the class of very pure water. When the albuminoid ammonia amounts to ·05, then the proportion of free ammonia becomes an element in the calculation; and I should be inclined to regard with some suspicion a water yielding a considerable quantity of free ammonia along with more than ·05 parts of albuminoid ammonia per million. Free ammonia, however, being absent, or very small, a water should not be condemned unless the albuminoid ammonia reaches something like ·10 per million. Albuminoid ammonia above ·10 per million begins to be a very suspicious sign; and over ·15 ought to condemn a water absolutely." According to the analysis of Mr. DeSouza the river above Naroo Shunker's Ghát, the highest point where it enters the town, contains ·14 parts of free ammonia and ·22 parts of albuminoid ammonia per million, so that even here according to Wanklyn's rules it is absolutely unfit for drinking, but it gets worse and worse as it flows past the town at Ram Khund. The quantity of both the free and the albuminoid ammonia is more than double, and at Dixit's Ghát it actually contains ·52 parts of free and ·74 parts of albuminoid ammonia per million. Comment is surely unnecessary to convince any one of the dangerous quality of such water.

Before the river reaches the town it is fouled by villages along its banks, and from the point it enters Násik above Naroo Shanker's Ghát it is fouled in almost every possible way. The refuse from the potters' kilns and from the place of deposit for town sweepings at Gharpurá's Ghát must find its way into the stream, whilst at the ford between Gharpurá and Dhángar Utara cattle are taken to water; and as they almost invariably micturate whilst drinking, it is not difficult to understand how the upper waters become fouled before they reach the Tas and the pool at Sunder Narayen whence great numbers draw their drinking water, especially when it is remembered that above these points the urine, ablution water and household sullage from a great portion of Aditwár are discharged into the river bed. The water in the Luximon and Ram Khund is simply diluted sewage, and lower down opposite Dixit's Ghat and between it and the Causeway is still more vilely polluted by percolation from the sewage delivered by the main drain.

Another source which is stated to be used by about 5,000 of the population is the water delivered at Dhondu Mahadeo Subedár's howd near Trimbak Gate. Unfortunately this water supply is private property, and much of it is used for irrigating a private field before it reaches the town; but even in its uncared-for and neglected state the water it delivers is of fair quality, though it contains ·12 parts per million of albuminoid ammonia, and would, if the tank and aqueduct become municipal property, no doubt after filtration be a very valuable source of water-supply. The municipality

in 1873 tried to purchase this property for a sum of Rs. 30,000, but unfortunately failed to come to terms with the owner and mortgagee of the property.

There are 825 wells in the town, generally of an impure character, 502 of which are in Kasba, 270 in Pura, and 53 in Panchvati. Only four of the wells are municipal property, three in Pura and one in Kasba.

The above description will portray the present sanitary state of Násik, and in the following section the vital statistics of the town, which have been doubtless to a very considerable extent influenced by the above conditions, are given. There has been a falling off in the number of births since 1874, when 636 births, equal to a ratio of 28·35 per 1,000 of population were registered. In India there are good grounds for believing that the annual birth-rate is about 40 per 1,000, so that instead of only 509 on the average, there ought to have been upwards of 940 births annually registered.

Since 1871 the death-rate has been abnormally high. It was lowest in that year, when it amounted to 32·98 per 1,000. During 1877 and 1878 it attained the very high rate of 64·09 and 78·40 per 1,000, respectively, but there were exceptional circumstances affecting the district in these years, but in 1872 it amounted to 57·94 and in 1875 to 51·30 per 1,000. During the last two years there has been a satisfactory decrease as the ratio in 1879 was 34·99 and in 1880 34·81 per 1,000. This rate, however, cannot be considered as anything but excessive in a town which enjoys such a salubrious climate and is so advantageously situated as Násik.

The following table shows the deaths arranged according to causes:—

YEARS.	Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other causes.	All causes.	RATIO OF DEATHS PER 1,000 OF POPULATION.						
								Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other Causes.	All Causes.
1871 - - -	61	16	270	58	10	325	740	2·72	0·71	12·03	2·58	0·45	14·49	32·98
1872 - - -	185	59	570	34	18	484	1,300	8·25	2·63	33·18	1·51	0·80	21·57	57·94
1873 - - -	—	1	458	15	17	548	1,089	—	0·04	20·41	0·69	0·75	24·42	46·31
1874 - - -	—	—	324	21	16	474	836	—	0·04	14·44	0·94	0·71	21·13	37·26
1875 - - -	168	1	357	46	11	568	1,151	7·49	0·04	15·91	2·05	0·49	25·32	51·30
1876 - - -	10	95	388	36	9	432	970	0·45	4·23	17·29	1·60	0·41	19·25	43·23
1877 - - -	158	128	597	94	11	450	1,438	7·04	5·71	26·61	4·19	0·49	20·05	64·09
1878 - - -	37	—	914	85	11	712	1,759	1·65	—	40·74	3·79	0·49	31·73	78·40
1879 - - -	—	—	432	56	9	288	785	—	—	19·25	2·49	0·41	12·84	34·99
1880 - - -	—	—	458	75	8	240	781	—	—	20·41	3·34	0·36	10·70	34·81
Mean for 10 years -	62	30	472	52	12	452	1,080	2·76	1·34	21·04	2·31	0·53	20·15	48·14

Although in 1872–1875 and in 1877 there were a large number of deaths from cholera, during four of the 10 years under report, not a single death was registered from this cause, so that the general high death-rate is not due to the prevalence of cholera. Nor is it due to small-pox, which in only three years of the series was prevalent in the town. It will be at once seen that the chief cause of the mortality in Násik is fever, whilst deaths from bowel complaints bear a much higher ratio to the total mortality than they should do.

The sanitary condition of Násik must always be regarded by the Sanitary Commissioner with peculiar interest and anxiety, as the welfare of the entire Bombay Presidency may at any time be affected by it, for if cholera originates here during the Játtra it is likely to spread throughout the country, as occurred in 1875, when, though there were only 10 deaths from this disease in Násik, a cholera epidemic commenced which told terribly against the people of this Presidency for three successive years, during which time 183,667 persons fell victims to it. There is no doubt that much of the immunity which the town has enjoyed from cholera is due to the efficient manner in which the Public Health Department has performed its duty. I am sorry, therefore, to hear that it has been proposed, although I believe not seriously entertained, to increase the income of the municipality by reducing expenditure in the Public Health Department. There could be no more fatal step or one more likely to cause great injury to the public health throughout the Presidency. On the contrary, every support should be given to it, such as has been given to it in past years by Mr. Erskine and is now given to it by Mr. Ramsay, and I trust such will be always continued; for it would indeed be sad to see the sanitary condition of the town retrograde to what it was when Dr. Leith reported on it in 1865.

I am glad to learn that the question of imposing a tax upon pilgrims has been mooted, which I hope will be carried, as it seems a very legitimate and proper means of increasing

the income. The Pandharpur municipality raises not less than Rs. 25,000 per annum from a pilgrim tax, and I can see no reason why Násik should not augment its income by a similar tax; but I would suggest that pilgrims should be taxed according to a graded scale, for it seems inequitable that a rich Bania should pay exactly the same amount as a poor artizan.

The necessity for increasing the income is very evident, for the tables of mortality prove that a persistently high death-rate always obtains in Násik, and its cause is, in my opinion, chiefly due to impure water and to an atmosphere vitiated by the dangerous emanations from the drains. In my opinion the Godávri should be abandoned as a source of drinking water, as the analyses made by Mr. De Souza prove that the water of the river even as it enters the town is so impure as to be unfit for drinking, and that it becomes increasingly bad as it progresses through the town. It would be out of the question to try and prevent the people bathing or washing their clothes in it, or to stop them throwing in their offerings or the burnt bones of their dead. These customs are intimately connected with their religion, and I am quite confident Government would never sanction such an interference with their most cherished prejudices. It is necessary, however, to mention that it has been proposed that a dam should be built across the river higher up at Gangapur, and that the water should be brought in by conduit; but there are many objections to such a scheme, among which I would point out that the water would be rendered impure by the villagers in Gangapur and at Jelalpur which are situated on either bank a short distance above the place where the proposed dam would be, and another fatal objection is that the top of the rock at Gangapur is so low that the water could not mount up to the higher portions of the town.

The next point to which I wish to draw attention is the very dangerous condition of the existing drains. I am sorry to learn that the drain cleaning establishment which was formerly sanctioned was discontinued by order of the managing committee. This I think was a fatal mistake, as I am confident that there must be a large deposit in nearly every drain in the place. The quantity of sewage delivered at the outfall is much smaller than it ought to be, and there can be no doubt that the sewage stagnates hurtfully in the drains, which being square and roughly made, offer points for it to collect. The smell emanating from holes over the drains is absolutely sickening, and must injuriously affect the health of the people passing over the narrow streets in which they are situated. Drains ought to be built of brick evenly laid in Portland cement, and should be egg-shaped, but, as it is estimated that there are altogether in the town some 10 or 12 miles of drains, I do not suppose that the municipality would be in a position for many years to replace them by scientifically constructed drains. At present the covering slabs are cemented down so that it would be an ever-recurring item of expenditure to open them for the purpose of cleaning. They could, however, be periodically flushed even at present by temporarily ponding up the water by segments, but I would suggest that at frequent intervals in the course of each drain a manhole should be constructed, which could frequently be cleaned of any deposit brought down to it. Although it would be too expensive to have a thorough drainage system, I think no time should be lost in laying an intercepting sewer along the whole course of the margin of the river bank from Janappa's Ghát, so that the stream may not be fouled by the admission of sillage into it.

I am glad to see the municipality recognises the necessity for providing more accommodation for the people in the shape of public latrines. Much has been done in this respect already, but still more is needed, as the vacant places throughout the town are horribly defiled, and it is disgusting to see the cattle eating human ordure before the place can be cleaned by the bungalies, who are very diligent in performing this work. I think the Goodfellow's latrines lately introduced are a great improvement over the older pattern, but in all latrines I look upon a roof as a great mistake, as it confines the stench. I think all the roofs should be removed, and if these places must be sheltered during the monsoon, corrugated iron sheds might be reserved for covering them at that season.

From the foregoing observations it will not, I hope, be thought that I in any way underrate the great difficulties the municipality has to contend against, for I am certain that it utilises to the utmost advantage the means at its disposal; but I have endeavoured to point out the measures which appear to me the best calculated to improve the sanitary condition of this very interesting old town.

ABSTRACT OF REPORT OF THE CALCUTTA MUNICIPALITY FOR 1881.

(*Mr. H. L. Harrison.*)

Census of
1881.

A fresh census of Calcutta having taken place during the year 1881, it seems a proper occasion to preface the annual report with a summary of the latest statistical information which has been compiled, regarding that portion of the metropolis which is under the control of the Corporation.

The following table shows the area of the town proper of Calcutta, as also of the Esplanade including the Presidency Jail and Fort William, and the population ascertained in 1881 as compared with the previous census of 1876. For purposes of reference similar figures are given for the Suburbs and the Port, but it should be specially noted that in the case of the Suburbs the previous census was taken in 1872.

			Area in acres.	Population in 1876 (Suburbs 1872).	Population in 1881.
Town proper	-	-	3,754	4,09,036	4,01,671
Esplanade	-	-	1,283	2,803	3,348
Total	-	-	5,037	4,11,839	4,05,019
Add population afloat	-	-	-	17,696	28,200
Suburbs	-	-	14,413	2,57,149	2,51,439
Grand total	-	-	19,450	6,86,684	6,84,658

Taking the population of the town and Esplanade together it is thus divided into sexes—

Males	-	-	-	1876. 2,64,863	1881. 2,60,780
Females	-	-	-	1,46,976	1,44,239
Total	-	-	-	4,11,839	4,05,019

The following figures showing the ratio of the sexes at different ages or stages of life are particularly instructive as setting forth in themselves the social condition of Calcutta almost without comment :—

			Percentage of Males.	Percentage of Females.	Percentage of Males and Females of the stated Ages to Total Population.	Similar Percentage in London.
From 0 to 4 inclusive	-	-	50·8	49·2	6·4	13·0
" 5 to 9	"	-	52·7	47·3	6·3	11·1
" 10 to 19	"	-	64·5	35·5	14·1	18·6
" 20 to 39	"	-	70·1	29·9	48·3	33·4
" 40 to 59	"	-	63·6	36·4	20·2	17·7
" 60 and upwards	-	-	48·6	51·4	4·7	6·2
Total	-	-	64·4	35·6	100·0	100·0

To complete the evidence afforded by these figures, it is only necessary to give the statistics of unmarried, married, and widowed persons of the two sexes, which are as follows :—

SINGLE.		MARRIED.		WIDOWED.		TOTAL.	
Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
84,346	32,135	1,65,296	59,382	11,138	52,722	260,780	144,239

The life of Calcutta—not of the Europeans and Eurasians, who are too small a fraction materially to affect the result, but of the great bulk of the native population, can be easily read in these statistics. They show that far more than half the inhabitants of the town are dishomed, that they are temporary sojourners only, leaving their families, in some cases even in early boyhood, to earn a livelihood in the metropolis. The percentage of male to female children under 5 is as it should be, but before the age of 10 the preponderance of males begins to appear, and between the ages of 10 and 20 it becomes very manifest. Between 20 and 40 there are more than two men to every woman, and even between 40 and 60 the excess is very considerable. Only after the age of 60 do the migratory bread-winners disappear, and the equality of infancy is restored in old age.

Of married men only 36 per cent. can have their wives living with them in Calcutta or the Suburbs, so that at least 64 per cent. of the able-bodied males of Calcutta are living away from their families. This being the case, and remembering that the municipal area of Calcutta is strictly circumscribed and cannot expand, it is no matter for surprise that the population has rather decreased than increased. The resident population cannot reproduce itself at a rate sufficient to compensate for the mortality of the whole community: hence the population will decrease or increase according as the demand for labour decreases or increases, and as Mr. Beverley points out, it is by no means certain that the great development of machinery does not tend to diminish the demands of the labour market.

The improvements that have been carried out in the town of Calcutta have been great, at the same time there still remains much that needs improving. Town improvements.

In 1860 the insanitary state of the town almost baffled description. A few years of vigorous administration, combined with the introduction of the drainage system into the southern portion of the town, so ameliorated its condition that the greater part of the European quarter underwent an entire transformation before 1870 or 1871. The northern portion of the town, however, embracing it must be remembered, by far the larger and more populous area, remained also almost untouched, except that one or two first class streets, especially Beadon Street and Grey Street, had been carried through it, and Beadon Square had been constructed. Since 1871 very little has been done for the southern portion of the town beyond the construction of the new market; except as regards bustees its sanitation has been regarded as nearly completed, but the work of improvement has been directed steadily northwards.

Under these circumstances, if special attention has not been paid to the condition of the southern portion of the town, it would be no matter for surprise. At first it was the show area of the town, the locality on which the main efforts of the conservancy officers were concentrated. Now the southern portion of the town has passed under routine management, the efforts of the superior officers of the municipality are rightly directed to improving the northern town, and levelling it up to the sanitary standard attained long ago in the south. Any one, therefore, who has only a practical knowledge of Calcutta south of Bow bazaar, is quite incapable of judging the work of the Corporation from his own personal observation, and any inference he might draw therefrom, as to the absence of sanitary progress, would be entirely misleading. On the other hand, weighed against an ideal standard of cleanliness, the condition of the northern portion of the town is still so glaringly defective that a person now visiting it for the first time, and not knowing what it was 20 or even 10 years ago, is equally disqualified from passing any judgment on the work done. Only those who have known this portion of the town well for many years past, and have observed its gradual but constant amelioration, especially in the wake of the drainage works, are fairly competent to criticise the work of the Commissioners in this respect.

The main agency at work, as above indicated, is the Drainage Department—the establishment which is engaged in the sewerage of nearly all the streets, and of many of the ditches in the town. A separate portion of this report is devoted to this, which is one of the great engineering departments of the municipality, under the special charge of an Assistant Engineer: here it will suffice to say that, during the year 1881, it made very good progress and completed over 14 out of the 36 miles of sewers which yet remain to be constructed in accordance with the fixed programme. The sewerage of each street enables the side-drains, formerly full of filthy sewage, to be filled in and obliterated, and the street to be thereby somewhat widened; it also enables all the premises on each side to be connected, and thereby provided with a channel for the escape of storm-water and sewage. On an average each mile of pipe sewerage enables 200 premises to be connected, though all that have the facility afforded them do not readily avail themselves of it. In 1881 as a fact 1,592 premises were connected, but as

the bulk of the new piping was laid in the 4th quarter of the year, many of the connections resulting from the sewers were not made before 1882.

Next to the sewerage and cleaning of existing streets, and the providing sewage connections for private premises, the great benefit conferred by the drainage operations is the construction of new roads over such sewers as have to be laid down through tracts where no road previously existed, and the substitution of metalled footpaths for such of the old filthy ditches as are no longer required. These ditches are now the greatest blots on the sanitation of the town; they contain the foulest matter in the most advanced stages of decomposition, and are practically mere stagnant cesspools between earthen banks, the soil of which is saturated with sewage. No greater improvement can be made than the substitution of a pipe sewer for a drain of this kind, and its conversion into a street or path, according to its width. In 1881 nine new roads were made in this manner by the Drainage Department.

The total length of public roads constructed or completed within the year comes to about 8,922 lineal feet, or about a mile and three quarters; nearly all of these roads will prove of great practical advantage. The first seven are north of Bow bazaar, and the last two south of it. Besides these roads about an equal length of public ditches has been converted into metalled paths or passages of an average width of six feet. Taken as a whole, very fair progress was made during the year in drainage and road-making.

Tank-filling proceeded as usual during the year, though the operation was somewhat impeded by—(1) the rains, which began early, and interrupted operations before the usual time; (2) the decision of a magistrate, which assumed that tank-filling on the system hitherto pursued was a public nuisance. On the other hand, the change in the law obliterating the distinction between the tanks within and not within private enclosures, enabled the Commissioners to recover a much larger portion of the expenditure than they had hitherto done. In all, 20 tanks were taken in hand in 1881. Of these 14 were entirely completed during the year, leaving six which have been completed in 1881.

In 1879 a survey was made of all the tanks in the town, which might be eventually filled up. It did not of course include the tanks on the maidan, or some other well-kept tanks in squares and private compounds. The survey showed that there remained 534 tanks to be filled up. Of these, 34 have been taken in hand in 1880 and 1881, leaving 500 untouched. It would, however, be a mistake to suppose that 500 tanks really require to be filled up. As remarked last year, the bustee register only shows 177 tanks, of which about one-tenth have been already filled up since the register was prepared. The great bulk of the remainder are in private compounds and are at present inaccessible to conservancy carts, while their condition is not nearly so bad as that of the tanks in bustees. Though the out-turn compared with the entire number of tanks appears small, tank-filling is really keeping pace with other improvements, and if another 100 of the worst tanks are filled up in the course of the next five or six years, there will not be many tanks left that are serious nuisances.

Bustees.

As regards bustee improvement it was stated last year that a register had been prepared of all the bustees in the town. This register shows that 98 bustees covering beegahs 518-2-8 are situated south of Dhurrumtollah or in Hastings. Only 80 bustees covering beegahs 352-13-14 in the four Wards 2, 5, 7, and 12, bounded by the river, 198 bustees covering beegahs 1,553-18-10 in the five Wards 1, 3, 5, 9, and 11, bounded by Circular Road, and 110 bustees covering beegahs 629-11-15 in the three Wards 6, 8, and 10 in the centre of the town.

Of these bustees the Chairman personally inspected 74 in 1881 (not including bustees casually visited) for the purpose of considering what action might be taken for their reclamation, in accordance with the classification and procedure adopted by the Commissioners for working the provisions of the Act.

The experience which the Commissioners have had of the working of sections 280 and 283 during the past year does not make them sanguine of being able to effect any very substantial improvement in the sanitary condition of bustees by this means. It is impossible to ignore the claims of private owners in the construction of roads through bustees; the road that is most needed by the owner of the parcel of land through which it passes, will rarely coincide with the road that will most benefit the entire block, and it is manifestly unjust to make one owner sacrifice himself for the benefit of another. At every step the Bustee Committee finds its projected improvements hampered by the legitimate objections of the proprietors, so that such works, as can be eventually insisted upon, fall very far short of the ideal project as first planned.

Again, the refuse which now remains in bustees unremoved, and which the opening of roads will enable the Commissioners to remove, is not by any means the greatest sanitary defect. The foul and filthy drains which intersect the bustees, full of festering sewage and manure is a far greater evil, and while little can be done to remove this under the bustee sections, there are other sections under which the Corporation have power to remedy these evils, though not without some expense. The filling up of tanks, a very important measure, can be done without resorting to the bustee procedure.

The Commissioners have no intention whatsoever of abandoning action under these sections which unquestionably lead to *some* improvements, while they enable many more to be carried out without resort to this cumbrous procedure by the knowledge that these sections remain to be appealed to as a *dernier resort* in case of necessity; but the only procedure by which comprehensive and thorough reforms can be effected is that of the new section 293-A.

It is but fair to state that many bustee-owners manifest a very creditable anxiety to improve their bustees, and anticipate the wishes of the Commissioners. Many instances have come to the notice of the Chairman during the year of bustee-owners who have carried out improvements without any coercive measures being even threatened.

Section 247 of the Act requires milkmen, cartmen, livery stable keepers and keepers of hackney carriages to take out a licence half-yearly for the places where they keep their animals, and allows the Commissioners in meeting to grant any such license subject to such conditions as they may think fit. In 1878 the Commissioners in meeting prescribed certain conditions both for hackney carriage stables and gowala bustees, and in 1880 Mr. Beverley, as acting Chairman, put this section of the law in motion with the best results as regards hackney carriage stables. The keepers of these stables were required to pave and drain them thoroughly, as a condition of obtaining a license; a few of them, perhaps, left the town, but 86 in all complied, and the improvement was very marked. Owing to the change in the Chairman this reform was not noticed in last year's Report of the Commissioners, though it was one of the most conspicuous reforms in the year. The Engineer, however, gave a detailed account of it in pages 40 and 41 of his report.

Precisely the opposite effect, however, was produced on the keepers of cow-sheds. In their case the conditions to be complied with, as prescribed in 1878, are the following:—

Every house used for the purpose of a cow-shed shall in future be raised at least 3 feet above the level of the ground, and shall allow of a space 5 feet in width and 7 feet in length for each cow stabled. The stable shall be paved with cut stones which can be supplied by the municipality, unless the stable be boarded or tiled. Each stable shall have a slope towards one side, and shall be divided by an open drain running into a cesspool 4 feet square, formed of masonry, plastered and cemented outside the stable.

No cow-shed shall be licensed if situated in a locality unapproachable by the municipal conservancy carts.

All milkmen shall be required to take out trade refuse licenses, the municipality undertaking to remove daily their stable refuse.

Gowalas may keep as much cow-dung as they may require for making fuel cakes.

The license fee required under section 247 shall be as follows:—

One rupee for twenty head of cattle, with four annas for every five above that number.

Eight annas for less than twenty head of cattle.

For animals, other than sheep, goats, or horned cattle, the maximum fee of rupees five may be imposed.

These conditions, if practicable, would effect a most marked improvement in the gowalas bustees, at present by far the filthiest bustees in Calcutta, but many of the existing cowsheds are unapproachable by conservancy carts, while the actual gowalas are, as a class, too poor to comply with the first condition.

Hence the result of the endeavour made in 1880 to enforce these conditions was a general combination of the gowalas against taking out licenses; so that it was found in June when the subject was looked into, that only two cowsheds in the town were licensed for the first half of 1881. Under these circumstances, if the cowkeepers were prosecuted, it seemed probable that they would be very leniently dealt with as the conditions were not such as they could practically comply with, and therefore after full consideration, it was thought better to waive conditions 1, 2 and 3 for all existing cowsheds that could not comply with them, at least for the year 1881. The gowalas were therefore informed by notice that these conditions would be postponed and called upon to take out licenses at once under pain of prosecution. This notice produced no effect as, after consulting with one another, they determined to keep up their combination, and prosecutions were then instituted.

Five hundred and sixty-six gowalas were prosecuted, of whom 335 were fined sums amounting to Rs. 756; the remainder were either warned only, on account of extreme

poverty, or discharged as keeping only one or two cows and not selling milk. The result of these prosecutions was that 373 cowkeepers took out licenses.

The policy being pursued in the present year is to enforce the conditions gradually, pressing in the first instance those who are in a position to comply. The taking out a license will be rigorously enforced, and a fixed time given to comply with each condition that cannot be at once conformed to. It is hoped that in this way the concert of the gowalas will be dissolved, and the requisite improvements effected by instalments.

There is one more agency at work for the improvement of bustees (described last year as the "unsystematic" agency) which certainly ought not to be ignored, that is, the serving notices on owners and occupiers to clean their bustees and compelling them to comply therewith, if necessary, by prosecutions. It would be a very great mistake to overlook the importance of this work. Few things are more patent in inspecting bustees, than that it is useless providing surface drains and other appliances for cleanliness, if the people will not make use of them when provided, and the great desideratum is to create that taste for sanitation which must underlie any great marked improvement. One of the necessary ingredients of this taste is the habit of cleanliness, and to some extent this habit can be formed by the fear of the law. It would be easy to point out many habits which can be traced to the provisions of the law strictly enforced. The residents of bustees prefer cleanliness though they will not take the trouble to secure it, and if they can be continuously coerced into taking the trouble, they will at last begin to take it spontaneously and without coercion.

Altogether 4,852 notices were served in 1881, and if all the improvements covered by them were rigorously insisted upon, and the procedure of serving notices systematised, it would soon produce very marked results. The Commissioners believe that much may be done to improve the town by careful and discriminating resort to the powers conferred on them by Sections 235-251 and by effective supervision over the work done in accordance with notices once issued, and it will be their special endeavour in the current year to give this a fair trial.

It will thus be seen that real progress is being made in sewerage streets, connecting premises with the sewers, constructing new streets, converting filthy drains into foot-paths, widening and improving streets, filling up tanks, and applying the procedure of the Act to bustees; also in enforcing sanitary measures by the service of notices. Four or five years more of such improvements as have been carried out in 1881, will make a very perceptible difference in the condition of the northern part of the town. At the same time, unless these measures are supplemented by others, the Commissioners are well aware that they will be abortive. The extension of the water-supply is the most urgent of all the needs of the town, as all the improvements which are being carried out require an abundant supply of water for their successful working. A sufficient establishment of conservancy carts is also a *sine qua non* to remove the annually increasing heaps of refuse which are being brought within their reach. Above all effectual and intelligent supervision over the Nuisance and Night-soil Departments, and the systematic enforcement of the conservancy sections of the law is indispensably requisite. These questions are under the consideration of the Special Conservancy Committee now sitting.

Water
supply.

The Commissioners may congratulate themselves on water having been supplied during the year 1881 without any serious disaster. The immunity from such disasters, which the waterworks have enjoyed during the 11 years that they have been working, makes it seem superfluous to notice, at any rate in terms of self-congratulation, such an ordinary occurrence, but as a fact, there is no branch of their work in regard to which the sense of responsibility weighs more heavily on the Commissioners than the waterworks. The filtered water having proved so universally acceptable, the residents of Calcutta have come to rely upon it with each succeeding year, more and more exclusively, so that a sudden cessation of the supply would now inflict the greatest conceivable hardship on almost every household in Calcutta. Yet any grave disaster to the head works at Pultah, where the water is drawn from the river, settled and filtered, any serious accident to the spinal cord of iron-piping which connects Pultah with the distributing station at Tallah, or to the machinery at Tallah, would paralyse the supply of water to the entire town.

Whether any such catastrophe, as is indicated above is likely to happen is fortunately still a matter of conjecture. Past immunity no doubt counts for much, but it should not lull the people of Calcutta, much less the Commissioners, into a sense of greater security than the circumstances of the case warrant. If year after year has passed and the waterworks have continued to do their duty, on the other hand no serious cyclone such as those which occurred in 1864 and 1867, has visited Calcutta since the

works were opened, and it must be still a matter of great anxiety to consider what the effect of such a cyclone would be.

How great the annoyance which any injury to the waterworks would inflict, may be inferred from the outcry which arose in August last when, owing to the unusually muddy state of the river, the filters at Pultah were choked, and the supply of water fell off by about 30 per cent. for a week or 10 days. This necessarily led to a scanty supply of water and to low pressure at all the hydrants, and if this caused, as it did, great discomfort even in the height of the rains, it may be inferred what the inconvenience would be if the entire supply were cut off for several days in succession. This actually had to be done for 37 hours on the 6th and 7th April, when the new independent main was being connected with the pumping station at Tallah, but the workmen worked night and day, and the people of Calcutta having been warned to lay in a supply of water, no serious inconvenience was caused.

The water once distributed from Tallah, any accident to a subsequent link in the machinery of supply would be but partial in its operation. Thus a serious accident occurred owing to gross carelessness, to the cylinder of one of the engines at Wellington Square in September. This necessitated the working with two engines instead of three at the Wellington Square Pumping Station for a whole month. It led to a decrease of pressure in that portion of the town, which is commanded by Wellington Square, for all that period, but the portion of the town commanded directly by Tallah experienced no inconvenience.

If the filtered supply suffered no serious disaster during the year, it cannot be said that it was working quite satisfactorily as regards the quantity of water supplied. Last year there was a falling-off in the average daily supply from 7,464,157 gallons to 7,407,256 gallons; this was followed in 1881 by a much greater decline, viz., to 7,208,453. Mr. Kimber attributes this partly to the 37 hours total cessation of supply at Tallah on the 6th and 7th April, partly to the choking of the filters in August and partly to a break-down at Wellington Square in September. As regards these causes, it appears that though there was a total loss of 37 hours at Tallah, the average supply in April exceeded the average supply in any preceding month of any preceding year, having risen to 7,875,537 gallons daily average. The break-down at Wellington Square, though it could diminish the pumping power of Tallah which determines the aggregate town supply, nevertheless checked the supply, because it checked its free distribution. The decrease owing to the choking of the filters, though it culminated in August, was in operation during the greater part of the autumn.

To the end of May the supply was even better than in the same five months of 1880, and exceeded a daily average of 7,680,000 gallons. In June the falling-off was rapid till it reached the lowest point in August, and it seems clear from experiments made in the end of August, that for some reason or other, the river was exceptionally charged with silt at that time and very probably throughout the rains of 1881.

The only important new work undertaken during the year in connexion with the filtered supply, was the laying down of the independent main between Wellington Square and Tallah, to enable the reservoir at the former to be filled during the night, without utilising the ordinary street pipes. It was found that 500,000 gallons disappeared nightly by this channel, mainly owing to leakage and waste, partly perhaps to water being taken during the night. This loss is now obviated. Still it cannot be denied that the supply is very insufficient and is daily becoming more so. 13,386 premises in the town are now connected, and the new connexions during the year amounted to 637. As premises are connected, the demand for water increases; careful experiments were made during the year to estimate the effect of connexion on consumption of water, and though the results must not be taken as more than approximate, they led to the inference that persons living in connected houses consume over 25 gallons a head per diem, while persons living in unconnected houses, who have the trouble of going to the hydrants to fetch their water-supply, consume only 5 gallons a head. If 600 new premises containing say 9,000 persons are connected annually, this means an increased demand of $9,000 \times (25 - 5) = 180,000$ gallons daily with each succeeding year. Moreover, the length and cubical content of the sewers is yearly being increased, these also require a more liberal water-supply to keep them in good order. It is therefore evident that too much importance cannot be attached to the urgency of increasing the Calcutta supply of water.

The evil, however, will be alleviated to some extent, when the arrangements now in progress for increasing the unfiltered supply are completed, as it is hoped they will be in the course of the current year. The average daily supply of unfiltered water in 1881 was 1,257,300 gallons which was 91,524 per diem more than in 1880. The new

engines are to be capable of pumping 2,000,000 gallons in six hours, and therefore by working 12 hours they will be able to supply 4,000,000 gallons, an amount considerably in excess of the entire wants of the town and Esplanade. It will therefore be possible to save nearly all the filtered water now used in watering the street estimated at 700,000 gallons per diem, and nearly all the filtered water used at latrines and night-soil depôts, estimated at 400,000 gallons. A million gallons per diem added to the present consumption of filtered water for household purposes will, to a very appreciable extent, meet the growing wants of the town for the next five or six years, *i.e.*, till 16,000 or 17,000 premises are connected.

Moreover, there are about 3,000 privies at present connected with the sewers, which are supplied with filtered water consuming, perhaps, 300,000 gallons daily. By Section 134 of the Act, the Commissioners have the power at their own expense of replacing this with the unfiltered supply. So that before the end of the current year, it may be hoped that the Commissioners will be in a position to set free about a million gallons per diem of filtered water for ordinary household consumption, susceptible of being increased at their option to 1,300,000 gallons. The benefit, however, will not stop here; the streets will be more liberally watered than at present, the latrines and night-soil depôts more liberally supplied, and new privy connections, which are not now permitted, can be again sanctioned: whilst the sewers which now only receive from the waterworks about $8\frac{1}{2}$ million gallons a day to assist in flushing them, will receive from the same source over 10 million gallons a day.

The Water Analyst describes the quality of the water in the following terms:—

The system of analysis carried out during the year 1881 has been the same as that followed during the previous five years. Two methods of analysis are made use of, the first a partial analysis which is performed twice in each week, and the second a full and complete analysis which is made at the commencement of each month.

The results of the partial analyses, are given in the following table:—

—			Number of Days on which Analyses were made.	Number of Days of Analysis when Water was Colourless and Transparent.	Number of Days of Analysis when Water was Opalescent, <i>i.e.</i> , when Filtration was not perfect.	Chlorine (representing Dissolved Sodium Chloride, &c.) in One Million Parts of Water.	Total Ammonia (representing Nitrogenous Organic Matter) in One Million Parts of Water.
1st quarter 1881	-	-	26	26	—	12·04	0·021
2nd do.	-	-	27	26	1	12·01	0·015
3rd do.	-	-	26	—	26	6·31	0·010
4th do.	-	-	26	23	3	6·02	0·011
Average for whole year 1881			103	75	30	9·10	0·015
Do.	do.	1880	103	74	29	9·49	0·030
Do.	do.	1879	103	91	12	8·50	0·035
Do.	do.	1878	103	75	28	8·37	0·034
Do.	do.	1877	104	72	32	10·40	0·046
Do.	do.	1876	155	137	18	10·65	0·037

On comparing the average numbers for 1881 in this table, with those of the previous years, they will be found to agree very closely in all cases except in the last column. So far as this method of analysis would show, it would appear that the water delivered in 1881 was of about the average quality, with the exception that the amount of nitrogenous organic matter contained in it was decidedly smaller. This last fact is shown by the column "total ammonia," and the amount of this substance found in 1881 was only 0·015 parts per million, as compared with an average of 0·036 parts as contained in the water of the previous five years.

This table also gives information as to the filtration of the water during the year, and from it may be seen that the filtration was imperfect on one day in the second quarter, and on all the days of analysis during the third quarter of the year. It will be also noticed that this is about the average result as found in the years 1880, 1878, and 1877, so that in respect to filtration, the condition of the water was very satisfactory. The table, however, gives no information as to the amount of the opalescence or turbidity, and although the water was thus reported imperfectly filtered during the rainy season or for three months of the year, yet the amount of opalescence was so slight, that, in the majority of instances, it would have escaped detection unless it was specially looked for. So far as can be judged, the water of 1881 was, if anything, rather better filtered than in previous years.

The next table contains the results of the full and complete analyses of the hydrant water made at the commencement of each month. The numbers obtained in each month are there given together with the average for the whole year, and the average numbers obtained in the three previous

years; there is also added for the sake of comparison, the average composition of all the waters supplied to London and the Suburbs for the first half of 1877.

Date of Collection of Sample.	Description of Colour, Transparency.	Total Solid Im- purity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Chlorine.	HARDNESS.		
									Temporary.	Permanent.	Total.
1st January 1881	- - - - - Colourless and transparent.	17.52	.133	.052	None	Traces not measurable.	.052	1.10	3.10	3.90	7.00
1st February "	- - - - - Do.	24.40	.083	.059	None	.023	.087	1.23	5.61	3.25	8.86
1st March "	- - - - - Do.	23.60	.087	.056	None	.009	.005	1.23	5.58	2.99	8.57
1st April "	- - - - - Do.	22.10	.101	.067	None	.018	.085	1.31	6.10	2.47	8.57
1st May "	- - - - - Do.	20.16	.095	.058	None	Traces only	.058	1.31	4.18	2.99	7.14
1st June "	- - - - - Do.	22.14	.089	.041	None	Do.	.041	1.14	3.00	4.71	7.71
1st July "	- - - - - Slightly opalescent and yellowish.	13.46	.115	.032	None	.023	.055	0.82	2.52	4.57	7.09
1st August "	- - - - - Do.	10.04	.075	.036	None	.062	.068	0.60	1.29	4.71	6.00
1st September "	- - - - - Do.	10.30	.093	.054	None	.025	.079	0.60	1.72	6.14	7.86
1st October "	- - - - - Almost colourless and transparent.	10.92	.474	.076	None	Traces only	.076	0.60	3.29	5.86	9.14
1st November "	- - - - - Colourless and transparent.	11.68	.200	.079	None	Do.	.079	0.53	5.18	2.99	8.14
1st December "	- - - - - Do.	16.16	.078	.032	None	Do.	.032	0.71	4.53	3.90	8.43
Average for year 1881 -	- - - - -	16.87	.135	.053	None	.014	.067	0.94	3.84	4.04	8.71
Do. 1880 -	- - - - -	17.03	.130	.045	None	.044	.089	0.98	4.04	3.04	7.08
Do. 1879 -	- - - - -	17.04	.107	.052	None	.016	.068	0.87	3.25	3.53	6.78
Do. 1878 -	- - - - -	17.30	.111	.054	None	.023	.077	0.87	2.21	2.91	5.13
Average composition for first six months of year 1877 of all water supplied to London and its suburbs	- - - - -	31.00	.160	.024	None	.328	.352	1.80	—	—	19.73

The numbers given in this table for the past year are strictly accurate with the exception of the columns "organic nitrogen" and "organic carbon." The numbers given in these two columns are not so trustworthy on account of the difficulty of obtaining accurate results in the foul atmosphere of the Corporation laboratory. This fact was, however, reported in special communications in 1880 and 1881, and also in the annual report for 1880. Taking the other columns into consideration, it may be seen that the water delivered in 1881 was of about identical composition with that of the previous years. In the case of the organic carbon and nitrogen, however, the numbers given would tend to show that the water of 1881 was decidedly more contaminated with organic matter than in previous years. This, it will be seen, is the reverse to what was found by the partial method of analysis, but in the latter case the results would not be affected by a foul atmosphere as the former process is. It is therefore impossible to criticise the analytical numbers with any degree of certainty, but it may be safely stated that the hydrant water delivered in 1881 was a pure and wholesome supply, and probably of a purity quite equal to that of former years.

The following shows the progress made during the year in completing the drainage of the town:—

	First Class Sewer Miles.	Second Class Sewer Miles.	Third Class Pipe Sewer Miles.
Total work as originally estimated	10.78	23	154
Complete to end of 1880	10.78	23	118.73
Balance uncompleted on 1st January 1881	—	—	35.27
Carried out in all 1881	—	—	14.15
To be done in 1882 and subsequent years	—	—	21.12

The balance, as the Engineer points out in his report, is somewhat below the mark, as the 154 miles include a lump estimate for sewers in ditches which were only computed from Simms' map, and not from actual measurement. This estimate has in many cases proved inaccurate, generally by way of defect, as branches and continuations of the ditches which it was found necessary to sewer, were not shown in the map. At the same time Mr. Kimber points out that this will not involve any serious addition to the estimate. The drainage of the town is therefore now fast approaching completion, and it may reasonably be hoped that by the end of the year 1883 the work will be concluded.

The cultivation of the land reclaimed by the deposit of sweepings at the Salt Water Lakes, is watched by the Commissioners with much interest. The lessee Baboo Bhubonath Sen is an energetic man, and does justice to the experiment which he has undertaken. All the conditions as regards soil and manure are excellent, but his great obstacle at present lies in the swarms of rats, pigs, and carrion birds that are attracted to the spot. Sometimes his labour and those of his ryots are rewarded by a splendid crop,

on other occasions just when the promise is best, the crop is destroyed by vermin. The nuisance caused by the skinning platform, which is situated at the entrance to the municipal land, is also very great, but this is the last year of it, as arrangements have now been completed to remove it to a more distant site.

Conservancy.

The Conservancy establishment labours under great difficulty. Though complaints are frequently received of the neglect to remove refuse, especially in the northern part of the town, and though in many of the bustees no conservancy arrangements are practicable for the removal of refuse, still the figures given in the Engineer's report show conclusively that year by year more and more is accomplished, and while the population of the town is known to have remained practically stationary, the amount of refuse removed has increased by more than 50 per cent. in the last four years.

The cleansing of sewers was well attended to during the year as shown by the fact that the cart loads of deposit removed from the gully-pits aggregated Rs. 10,806 against Rs. 7,463 in 1880, and an annual average of Rs. 7,689 in previous years. The constant increase in the length of sewers manifestly tends to an increase in the silt to be removed, but the large increase over 1880 is also due to the rain-fall having been much more abundant in that year.

ABSTRACT OF REPORT OF THE HEALTH OFFICER FOR CALCUTTA FOR 1881.

(Dr. K. McLeod.)

The number of births registered during the year fell short by 94 of the total registered in 1880, and exceeded the average of the preceding decade by 1,280. The improvement manifest in the figures of 1880 is therefore practically sustained but not advanced. The figures of 1881 present the same peculiarity in respect of excess of births in the cold months, which those of the previous year and the decennial mean exhibit. This feature is possibly due to the population of the town being larger in these months. Of this, however, I possess no statistical evidence. Vital statistics.

Statement of Births registered in Calcutta from 1871 to 1881.

YEARS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio per 1,000 of population Census 1881.
1871 - - -	448	364	350	410	368	348	387	409	503	566	540	476	5,169	11·9
1872 - - -	540	342	455	345	340	305	333	390	396	397	398	326	4,564	10·5
1873 - - -	294	288	354	373	354	300	369	456	419	437	500	499	4,593	10·6
1874 - - -	452	334	348	317	369	343	394	408	392	430	420	456	4,668	10·7
1875 - - -	415	334	393	778	606	570	569	633	650	720	727	606	7,001	16·1
1876 - - -	498	500	576	541	509	568	694	665	710	705	769	719	7,452	17·2
1877 - - -	570	552	588	706	427	491	647	648	709	703	661	755	7,457	17·2
1878 - - -	638	580	611	550	526	489	496	607	573	653	640	612	6,925	15·9
1879 - - -	482	464	450	428	458	430	410	497	604	668	723	795	6,409	14·7
1880 - - -	549	501	591	556	580	580	620	583	668	766	774	784	7,552	17·4
Mean of 10 years	488	415	471	500	453	442	491	529	562	604	614	602	6,178	14·2
1881 - - -	661	620	599	595	492	548	584	568	605	706	750	730	7,458	17·2

The rate of 17·2 per 1,000 of population, which the returns of the past year render, has been calculated on the figures supplied by the census of the town taken on the 17th of February 1881. These figures have been employed as the basis of calculation in all the statements and returns contained in and appended to this report, previous ratios being left undisturbed. The differences between the census of 1876 and 1881 are so inconsiderable as to render adjustment of the population for intervening years unnecessary. In discussing the vital statistics of the town for the year under report, I shall have occasion frequently to refer to the excellent report on the census of 1881, prepared by Mr. H. Beverley, C.S.

One of the subjects specially discussed by Mr. Beverley is the probable accuracy of the birth-rate of Calcutta. He points out that the disparity between the sexes in Calcutta makes any comparison with towns where the sexes are more equally balanced, or the female population in excess, fallacious. On the other hand, the proportion of married females appears to be higher in Calcutta than in English towns, and it is a well-established statistical law that the higher the proportion of married females, the higher the birth-rate. Making allowance for these two circumstances—the excess of males on the one hand and of married females on the other—Mr. Beverley finds that 24 per 1,000 would be an approximately correct rate for Calcutta according to European standards, and concludes that the registered statistics of births in Calcutta are still very imperfect. It is possible, however, that the proportion of married females (61·4) is overstated, and that the average family is not so large as in England.

The number of children under one year of age found alive in Calcutta on the 17th of February 1881 was 6,087. There were born in the town during the year 7,458, and 2,577 children under one year died. Roughly, therefore, the number of living children should be 4,881, or 1,206 fewer than were actually discovered by the census. It is

improbable that a mistake of this magnitude crept into the census, or that so large a number of children born elsewhere are annually brought into Calcutta during the first year of their life. It seems certain, on the whole, that birth registration is still not quite what it should be, but I am inclined to believe that its results are not so far below the truth as a superficial comparison with European standards would indicate. I hope to be able in time to test the accuracy of the registration figures through the agency of the Vaccine Department; meantime the birth returns must be accepted with reserve.

The death-rate of 1881 is somewhat in excess of the decennial average, and holds the fifth place in the series of 11 years—1871–81. The statistics of the year are favourable as regards bowel complaints, fevers, and small-pox, and unfavourable as regards cholera and “other causes.” There was an epidemic of measles in the hot-weather; but with this exception the town has been very free of infectious disease. The following table presents the main facts of the year in comparison with the previous decade. The returns representing mortality may be accepted as correct in so far that very few, if any, deaths occurring within the precincts of the town escape registration; but in a floating population consisting largely of adult immigrants, very many persons seized with mortal illness are removed to end their days elsewhere. This circumstance renders the death-rate of Calcutta fictitiously favourable.

Statement of Deaths from the most Prevalent Diseases from 1871 to 1881.

YEARS.	Cholera.	Diarrhœa and Dysentery.	Fever.	Small-pox.	Other Causes.	Total.	Ratio per 1,000 of Population. Census of 1881.
1871	796	1,488	4,242	33	3,730	10,289	23·7
1872	1,102	1,365	4,895	18	2,972	10,352	23·8
1873	1,105	1,351	4,632	33	3,235	10,356	23·8
1874	1,245	1,358	4,461	120	4,343	11,527	26·6
1875	1,674	1,579	5,328	720	4,785	14,086	32·5
1876	1,851	1,864	4,361	71	4,817	12,964	29·9
1877	1,418	1,683	5,151	67	5,385	13,704	31·6
1878	1,338	2,010	6,086	1,495	5,467	16,396	37·8
1879	1,186	1,516	4,796	772	4,774	13,044	30·1
1880	805	1,267	3,797	114	5,698	11,681	26·9
Mean number	1,252	1,548	4,774	344	4,520	12,439	28·7
1881	1,693	1,491	3,765	133	5,948	13,030	30·0

In dealing with the particular diseases which have been assigned and registered as causes of mortality, it is necessary to state that the statistics of the town must be accepted in this respect with very great reserve. The recognition of the diseases causing death depends in many cases on exact diagnoses made by skilled medical practitioners; but in the majority of instances the identity of the disease is very doubtful as the information has been furnished by ignorant relatives according to their own vague notion of what the fatal malady was. Even as regards the four principal groups of death causes which have been specified in many of the tables embodied in this report—cholera, small-pox, fevers and bowel complaints—the figures are somewhat indefinite. The return of cholera is perhaps the most accurate, because the disease is a very striking one, and not easily mistaken for any other. Deaths from chicken-pox and other eruptive diseases doubtless find a place under the term small-pox. Fevers certainly include many fatal diseases in which fever is a mere phenomenon or symptom, and the same remark is applicable to fatal fluxes. The elaborate tables appended to the report are to be accepted as rather an effort towards refinement and completeness of detail in the future than as a true representative of present death causes.

Vital statistics relating to the Suburbs are probably entitled to less reliance than those of the town, particularly as regards registered death causes. Still as they are more likely to err by defect than excess, and as the four main groups of death causes referred to in the last paragraph are probably approximately correct, the following table is introduced for comparison with the figures of Calcutta. The higher death-rate of the Suburbs is a striking and indisputable fact. The death-rate of 1881 was 44·3 per 1,000 of population, against 30 for the town, representing an excess of nearly 50 per cent., which accords closely with the experience of past years.

Suburban Deaths in 1881.

MONTHS.	Cholera.	Small-pox.	Fevers.	Bowel Complaints.	Other Causes.	Total.
January - - - -	95	4	511	198	317	1,125
February - - - -	122	16	394	134	227	893
March - - - -	341	18	417	104	205	1,085
April - - - -	343	7	360	96	197	1,003
May - - - -	85	6	316	104	193	704
June - - - -	36	1	286	61	164	548
July - - - -	35	—	315	92	206	648
August - - - -	70	1	417	88	224	800
September - - - -	79	2	309	98	209	697
October - - - -	103	1	410	111	279	904
November - - - -	234	—	592	153	295	1,274
December - - - -	336	—	622	237	267	1,462
Total ¹ - - - -	1,879	56	4,949	1,476	2,783	11,143
Ratio per 1,000 of population	7·4	·22	19·6	5·8	11·6	44·3

Although the prevalence of cholera in 1881, as indicated by the registered mortality, does not transcend the limits of the more favourable years commencing with 1870, and presents a marked contrast with the years preceding that, still the results are far from satisfactory. The aggregate of deaths is a little more than twice as large as that of 1880, and the mean of the preceding decade is exceeded by 441; 1881 takes its place among the worst years of the series of reduced cholera. The suburban mortality from cholera was as usual, higher than that of the town, the ratios of deaths to population being respectively 7·4 and 3·9. It is noteworthy that the percentage of increase in the suburbs was 91 against 110 for the town.

The cholera ratios of 1881 follow generally the rule of the preceding decade, and the few departures from the rule may be viewed as fluctuations due to small numbers.

The figures also sustain the general experience of the year, that the disease was distributed sporadically throughout those parts of the town habitually prone to it, and that no localization or spread of an epidemic kind became manifest. The same tendency to grouping around foul tanks and filthy wells was observed as in former years; but the only instance of anything approaching a demonstration of the determining influence of fouled air and filthy water which came under notice was the following remarkable occurrence, whose incidents I carefully investigated at the time, and shall place on record as a good illustration of the circumstances under which localization of the disease is apt to occur in Calcutta.

Seth Bagan is a dense collection of tiled huts, surrounding two very filthy tanks situated a little to the east of Upper Chitpore Road (No. 85). In the hot weather of 1880 I inspected the place carefully and drew attention to several glaring sanitary defects which I observed—more particularly, the foul tanks, general uncleanness of the *bustee*, and the filthy drains loaded with organic impurity pervading it. Improvements had been commenced when the events which I am about to relate transpired. Cholera had not broken out in the village or its neighbourhood up to this time, though some 27 deaths had occurred sporadically in the Jorasanko Section. On the 26th of March some sweepings were, through a mistake of the Conservancy Department, thrown into the more southerly of the two tanks, which had not been previously de-watered. The villagers went on using the water for bathing, washing dishes, &c. A fatal case of cholera occurred in a hut on the immediate west of the tank on the 28th, and an old woman died of purging in another hut close by on the same day. Another death from cholera happened in a hut to the south-west of the tank on the 2nd of April. On the 5th of April a quantity of putrid dall, which had been condemned by me, was, through a mistake of the Conservancy Department, thrown into the tank. This material exhaled a foul stench, but the people still went on using the water. Cholera seizures occurred on the 6th, 7th, and 8th in the hut next to the heap of putridity, resulting in four deaths. Another case occurred to the west of the tank which recovered. Thus eight cases, of which seven proved fatal, broke out on the borders of this hollow immediately or shortly after these putrid materials had been thrown into it. Two deaths subsequently took place in another part of the village on the 16th and 18th of April near a foul drain which was in process of being piped.

The evidence now recorded is not demonstrative, but it amounts to a very high probability that the filth deposited in this tank was the exciting cause of the outbreak in

Seth Bagan either through the medium of the air or water. I investigated several other cases during the year in which filth and cholera were intimately associated, but none so clear as the above. On the detection of the outbreak and the circumstances associated with it prompt steps were taken to empty the tank and disinfect the putrid heap. The tank has now been filled up, the drains piped, and the village generally improved; and since the events described no report of unusual sickness or mortality has reached me.

Bowel complaints.

The mortality from dysentery and diarrhoea was below the average, but above that of the previous year. The seasonal fluctuation of these diseases follows the rule of fevers rather than cholera, exhibiting a well marked cold weather maximum and rains depression, and an intermediate gradual elevation and depression. When cholera is rising in spring, fevers are falling. The term indeed covers a complex group of diseases, some, perhaps, allied to cholera, most, probably, associated with fever, and discussion of figures relating to a term of this kind would, without, an analysis, which is not available, be unprofitable.

In the Suburbs, the year was comparatively favourable as regards bowel complaints, and it will be observed that the seasonal flow and ebb accord with that of the town. The suburban death-rate is 5·8 against 3·6.

Fevers.

The year was exceedingly favourable as regards fatal fevers, the total being below that of any year of the preceding decade. In the Suburbs also a great abatement took place from the very high figure of the preceding year. The suburban fever-rate was 19·6 against 8·6 for the town—more than double. The seasonal fluctuation in both cases was normal, the minimum being in June and the maximum in December; intermediate months exhibiting a gradual rise and fall. The varieties of fatal fever, defined in the return as typhus (four deaths), enteric or typhoid (569), simple continued (1,825), ague (48), and remittent (1,318). The numbers entered under these heads are, in the absence of accurate diagnosis, subject to great doubt.

The large number of deaths registered under the head of “enteric or typhoid fever,” namely 569, would indicate that this disease is a very prevalent and fatal disease in Calcutta, but I am inclined strongly to doubt the accuracy of the figures. Two hundred and seventy-six of the deaths entered under this head occurred among children in the first year of life, and 515 under five years of age, leaving a balance of 54 for all the remaining ages. This is contrary to experience. The following statement brings out clearly the anomalies of the Calcutta figures:—

	London, 1879.	Calcutta, 1881.
Deaths per 1,000	·23	1·3
Deaths under one year per cent. of total deaths	1·8	48·5
Deaths under five years per cent. of total deaths	14·6	90·5

Taking the statistics of Christians (European and Eurasians) the deaths registered under typhoid fever are only nine in number, equal to ·39 per 1,000 strength, and of these not one occurred under 20 years of age. It is among the Hindus and Mahomedans—indigenous races which army statistics prove to be less prone to typhoid—that the large numbers and high rates appear.

The experience of the hospitals is opposed to the idea that typhoid fever is a common disease in Calcutta, or on the increase.

I have further ascertained that in the garrison of Fort William only one case of typhoid fever has occurred during the last seven years, although the admission rate from the disease has been as high as 11·5 per 1,000 among the European army of Bengal, and the death-rate 4·6.

If the influences causing enteric fever were rife in Calcutta, the European soldier, so prone to succumb to these in other stations, would inevitably contract the disease.

The general inference deducible from these facts and considerations is that typhoid fever is not a formidable cause of sickness and mortality in Calcutta, and there is no reason whatever to suppose that the disease has arisen or increased in the town with the construction and development of an underground system of drainage and sewerage. I have, in a tolerably extensive practice, met with but one case of typhoid fever, and other medical practitioners have communicated to me a similar experience.

Small-pox.

The mortality from small-pox has been moderate, and the year takes its place in this respect among those in which this disease prevails sporadically rather than epidemically. The registered deaths took place during the first six months, only two casualties having been recorded in the last six.

The system of vaccination, initiated in 1880, has been seduiously worked. The old Vac cination system of domiciliary vaccination is still followed to a great extent, but the people are being gradually trained to resort to the public stations or to apply there for home vaccination. Considerable assistance has been derived from the registration of births, but greater benefit from this aid will be reaped in future years, for the period allowed by the law only began to lapse towards the close of the year under report. Only one prosecution has been as yet found necessary and the most obstinate *itcha* families are induced to yield to persuasion and judicious pressure.

The total of operations has been a little less than that of 1880 (6,538 against 6,747); however, the number of primary vaccinations has been higher (5,523 against 5,349). The amount of infant vaccination is about the same and the ratio of success good. The work of the year, though contrasting favourably with previous non-epidemic years, is far short of the requirements of the town.

There can be no doubt or question that the sanitary state of the town, though in many Sanitation. respects greatly improved, is still most unsatisfactory. The progress of road making and drain piping results every year in a palpable reduction of uncleanness and in increasing facility of filth removal. During the year under report this good work has been actively pushed, and to many foetid *bustees* has been granted access of air and conservancy carts, while many stagnant ditches reeking with foul putridity have been obliterated, and their place occupied by clean paths beneath which glazed pipes convey to adjacent sewers the materials which formerly festered and stank. Tank-filling has also been actively prosecuted as agency and material have become available. 24 of these filthy hollows, in addition to 47 wells, were reported during the year as having had cases of cholera in their immediate vicinity. The number of tanks filled up during the year amounted to 21.

In order to test the quality of the soil-water of Calcutta and demonstrate the impossibility of obtaining anything like safe drinking or cooking water out of hollows dug in Calcutta soil, I caused three trial-wells to be sunk in three bustees, and the water obtained from them to be analysed. The results of the experiment are shown in the following tabular statement:—

Locality.	Soortee Bagan.	Mitter's Lane.	Putwar Bagan.
Description of well	Dug on 12th February in the centre of the bustee in a clear square adjoining a road. Houses about 15 or 20 feet distant. Privies and open drains in the vicinity. Well about 15 feet deep. Water 12 feet from surface. Soil, clay and gravel for 8 or 10 feet; sand below. No tank in neighbourhood.	Dug about the same time in an open spot about 300 feet square. Houses on three sides, a large tank on the fourth. Well about 15 feet deep. Water 10 feet from surface. Soil clayey for 6 feet. Sand and clay mixed below that.	Dug about the same time. Open spot 12 feet from a lane. Houses about 15 feet distant. A filthy surface drain, about 15 feet off. Well 13 feet deep. Water 8 feet from surface. Soil clay mixed with sand.
Physical characters of water.	Blackish colour; rather opalescent. Contained a small quantity of suspended matter and some animal life. Gave out a most offensive smell.	Slight yellow colour. Contains a trace of suspended matter and some animal life. Gave out a faint unpleasant smell.	Slight yellow colour. Contained a little suspended matter and some animal life. Emitted a slightly unpleasant smell.
Chlorine in parts per million.	663.85	608.5	798.75
Total ammonia in parts per million.	91.0	2.4	0.746
Remarks	Examined 9th March	Examined 28rd March	Examined 3rd May. Ammonia had probably escaped.

The analyses were made by Mr. A. Pedler, analyst to the corporation. It is clear that water obtained by digging in the soil of Calcutta is quite unsafe and unsuitable for domestic purposes of all sorts. The filling up of tanks and wells constitutes, therefore, one of the main sanitary requirements of Calcutta. Some complaints were made regarding the use of road sweepings for this purpose, and in one case a prosecution was instituted on the score of nuisance caused to the neighbourhood in this way. Better material is very expensive and hard to get. Strict rules have this year been laid down regarding the mode of filling up tanks with sweepings so as to minimize offence. But the temporary inconvenience of the process constitutes an infinitely smaller risk to health than the use of the poisonous fluid contained in these hollows involves.

Since the close of the year a special committee of the Commissioners has been appointed to take into systematic and detailed consideration the question of improved appliances and increased establishment for the removal of filth. The earnest and practical manner in which the business of this committee is being conducted gives encouraging promise that important sanitary reforms will result from its deliberations.

The quality of water supplied to the town continues to be satisfactory. The need of a larger supply has forced itself on the conviction of the Commissioners, and the question of how to accomplish this with the greatest possible economy and without sacrifice of purity is at present under consideration. Measures are meantime in progress for increasing the supply of unfiltered water. This will make a sufficient quantity of water available for such important sanitary purposes, as flushing drains, watering roads, &c., and will liberate for domestic use a considerable amount of filtered water which is now being used for these purposes.

ABSTRACT OF REPORT OF THE MADRAS MUNICIPALITY FOR 1881.

(Mr. A. T. Arundel.)

The diversion of sewers from the Cooum and the canal has been steadily kept in view. Drainage.
The diversion of the large sewers opposite the Salt Cotaurs and by Elephant Gate Bridge, begun in 1879, was completed in 1880. Two smaller sewers that pass under the railway and fall into the canal were also diverted. Two drains near Colonel Law's Bridge were diverted from the Cooum and used to irrigate grass-beds in the Napier Park. A seventh large sewer was similarly diverted and utilised in the People's Park, and an eighth was diverted from a filthy tank at the end of Sydenham's Road. In another year or two it is to be hoped that the Cooum will be freed from all sewage except what is brought in during heavy rains, and its general condition greatly purified.

The Commissioners having approved the scheme of the Vice-President, Mr. Jones, for the drainage of Black Town, which had also been accepted by Government, resolved to sanction the raising of a loan of Rs. 1,00,000 to commence the work. It was at first arranged that the municipality should purchase the harbour works engines for which it was supposed that there would be no further need. The cyclone of November showed that the engines would still be required for the harbour itself. It therefore became necessary to purchase new engines from England, and accordingly Messrs. Gwynne and Co., who are providing the centrifugal pumps for lifting the sewage, also received orders for the engines to drive the pumps. The municipality are the gainers by this arrangement as the harbour engines would have needed considerable alterations and increasing charges for repairs. The sanction of Government to the raising of the loan was received in December, but the loan was not raised in the year under report.

The extensive deposit of sand caused by the harbour works greatly increased the nuisance caused by the discharge of the main drain north of the Fort, for the mouth of the drain was above 230 feet from the sea, and the sewage had to flow this distance over the sand to make its escape. At a meeting on the spot with Colonel Sankey, Colonel Ross Thompson, Mr. Thorowgood and the Vice-President, it was resolved to recommend, for the approval of Government, Mr. Jones' scheme of extending the main drain to the sea. The Government sanctioned the proposal and allotted Rs. 13,600 to carry it out.

At a meeting in the month of September the Commissioners determined to complete Water supply.
as far as possible the distribution of the Red Hills water throughout so much of the area of the city as was intended to be supplied, and for this purpose they sanctioned the raising of a loan of Rs. 2,50,000, a sum which, it was estimated, would complete the work. Preliminary arrangements were made to carry out the work, and the sanction of Government was received in December, but the loan was not raised till the ensuing year.

A granite fountain was erected in Pycroft's Road for the use of the public by the liberality of M.R.Ry. P. Annamalai Chetty. Forty-one hydrants were fixed to supply water against fires and for watering roads and trees, and 10 new fountains were set up.

The supply from the Red Hills Lake was maintained throughout the year except on the 3rd and 4th July, when the supply was shut off to clear the channel of weeds. The quantity of water drawn off from the lake into the delivery channel was 4,839,592 cubic yards for which payment has to be made to Government at the rate of one rupee per 1,000 cubic yards.

In order to check with accuracy the amount drawn off, a self-acting clock-work gauge was ordered from England, but was not received during the year under report. The water drawn off represents a consumption of $11\frac{1}{4}$ gallons per day for 200,000 persons.

The cost of this most important of municipal duties (Conservancy) was Rs. 2,19,806. Conser-
vancy.
One thousand and seventy-nine coolies and 532 carts were maintained, besides four large canal barges for the removal of rubbish and filth of all kinds. Three hundred and fifty-three thousand seven hundred and eleven cart-loads were thus removed, besides about 20,000 tons of night-soil. The Conservancy staff is inadequate, and a complete system for the cleansing of privies and latrines throughout the town is much needed. Financial difficulties are the sole impediment.

Great improvements have been effected in the Tinnevely Settlement and Nagatha Covil Parcherries. These places, and particularly the former, were the most loathsome and filthy quarters of the town. The latter has been entirely removed. Through the former have been driven lanes and streets, some parallel to each other checkerwise, laying the place thoroughly open to inspection and sanitation. A small conservancy staff was attached. As the Vice-President remarks, one result has been the immunity of this place from cholera during the recent outbreak, though it was specially attacked before.

Health of Madras.

The birth-rate per 1,000 was 40·3 as compared with 40·4 in 1880, 41·8 in 1879, and 37·9 in 1878. The total number of births was 16,025 as compared with 16,077 in 1880. The percentage of male births to female was as 50·8 to 49·2. I do not yet feel satisfied as to completeness of the registration of births.

The death-rate was 38·9 against 37·4 in 1880, and 34·7 in 1879. The total number of deaths was 15,487, exceeding those of 1880 by 580. The cause was the prevalence of small-pox, measles, and fever, as the following brief statement shows:—

		1880.	1881.	Increase.
Deaths from small-pox	-	869	1,654	785
„ measles	-	105	299	194
„ fevers	-	3,549	3,698	149
„ cholera	-	2	126	124

The first attack of cholera occurred in the month of September, and was believed to have been imported from the great concourse of pilgrims at Upper Tripatty in North Arcot. Special arrangements were at once made in the Conservancy Department for an increased number of carts and scavengers, and for other requisites for improved sanitation in the places attacked. A complete history of the attack must be reserved for the following year, when it passed away.

Vaccination.

The total number of cases vaccinated was 30,908 against 25,066 in 1880. The successful cases were 27,643, the unsuccessful 1,960, while 1,305 were not traced. The number of infants under one year vaccinated was 8,798 as compared with 8,172 in 1880. The number of vaccinations under one year as compared with the number of births is as follows:—

	No. of Births.	No. of Vaccinations under 1 year.
Europeans and Eurasians	490	359
Hindus -	12,495	7,392
Mahomedans -	1,813	949
Others -	678	98
Total	15,476	8,798

It thus appears that only about one-half of the children born in Madras are protected against small-pox within a year of birth.

With regard to general results, 17,894 males were vaccinated, and 13,014 females, a proportion which is perhaps as good as could be expected. The Commissioners at a meeting in August resolved to require a certificate of protection against small-pox from every child brought up to be examined for educational result grants, but the rule did not come into operation before the close of the year.

The number of deaths from small-pox during the year was 1,654, as compared with 869 in 1880. It is much to be desired that vaccination be made compulsory as approved by the Commissioners in their resolution of the 28th November 1879. The Government were specially addressed on this subject in the course of the year, but no decision has been received.

ABSTRACT OF REPORT OF THE BOMBAY MUNICIPALITY FOR 1881.

(Mr. E. C. K. Ollivant.)

Among the principal sanitary works in progress during the year were the construction of new main sewer from Carnac Bridge to Love Grove, new outfall sewer from Love Grove to the sea, new pumping station at Love Grove, pipe sewers in connection with the new main sewer, raising of Tulsi dams, construction of the Bhandarwada reservoir, and new milch cattle stables at Agripada. Sanitary works.

The new main sewer, in length $4\frac{1}{4}$ miles, was brought to a satisfactory completion on the 1st June, about 17 per cent. of the whole work having been executed during the year. The outfall sewer was also completed, about half the work having been done in the year under report. Unfortunately just before the monsoon there was an unusually heavy sea, which resulted in the displacement of the rubble and concrete covering for a length of 192 feet, but the pipes were uninjured. The foundations of the new pumping station had been completed before the close of the year, and Mr. Walton confidently anticipates that the new engines will be working at the end of this monsoon. The progress of the pipe sewer work was very unsatisfactory, and there was occasion to find frequent fault with the contractors for dilatoriness. Out of rather more than $23\frac{3}{4}$ miles of pipe about $16\frac{1}{4}$ had been laid by the end of the year.

Similar complaints have been made with reference to the contractors entrusted with the construction of the Bhandarwada reservoir. At the end of the year 66·7 per cent. of the contract time had expired, but only about 36·3 per cent. of the work had been completed. There have to a certain extent been unexpected difficulties, but with every allowance for these the slow progress made by the contractors cannot be justified, and, as it is of the greatest public importance that the reservoir should be available for use as soon as possible, it will now be a question whether the contract must not be taken out of their hands.

The dams of the Tulsi Lake were raised 6 feet before the monsoon, and at the close of the monsoon the level of the lake was $2\frac{1}{2}$ feet higher than at the same period of the previous year, and nearly 2 feet higher than it could have been if the dams had not been raised. The additional storage thus obtained is calculated at 234 million gallons, less than half the increase which it was hoped the raising would secure. But the rainfall was only 86·11 inches, or 15·32 less than the five years' mean. The cost of the work was Rs. 69,621.

A new milch cattle stable was in course of construction, and this has since been completed. Provision for the further extension of similar accommodation has been made in the Budget for the current year. But this is not enough. The municipality cannot be expected to build cattle stables sufficient for the wants of the whole city, and little will be gained by getting rid of ill-constructed stables in one quarter, which are without drainage and proper water-supply, only to find them re-established in a like condition in another. Proprietors of stables must be compelled themselves to build in accordance with sanitary regulations if cattle are to be kept in the city at all, and it may be worth while to allow a certain quantity of water free, or at very reduced rates, to encourage the desired improvement.

The supply of pure water in some of the outlying districts is very deficient, and the Health Officer has commented on the suffering from guinea-worm experienced in the neighbourhood of Matunga. The question of providing a better supply is engaging my attention. It comprises the consideration of supplying water to Bandora and Kurla, which are beyond our limits, and the objection to tap the main before it reaches the storage reservoir. The subject will shortly be discussed in a separate report. Water supply.

Dr. Weir has written strongly on the ill-drained condition of various parts of the city, especially the Fort, Nagpada, Khara Talao, Phanaswadi, Kamathipura, and Dhobi Talao, the latter with regard more particularly to house connections which have been allowed to get into disrepair. I agree with all that he has said, and Agripada and Parel might with equal justice be added to the list. But a great step in advance has been taken by the Corporation in providing grants for improvements in public works. Phanaswadi Drainage.

will come within the new sewered district. The sewerage of Kamathipura is now nearly completed. As soon as the new pumping station is ready for work, experimental house fittings will be connected with the new sewer, and as far as the sanctioned works are concerned it now rests with the Executive Engineer to push them on with rapidity and efficiency, in order that the result may be satisfactory, and that these works may be succeeded by others. Meanwhile there is an urgent necessity for a complete survey, in order that any local work done may fit in with the general design, and because the well-grounded complaints of the present state of the Fort and other districts named make it impossible that the remedy should be long delayed. The first and most important requirement is to provide good sewers where now there are stagnant cesspools, and to join these new sewers with the new main artery completed last year. On the subject of house connections I have only to say that the Corporation have wisely determined to place their construction and control entirely in the hands of the municipality, whatever determination may hereafter be arrived at regarding payment of the cost. The necessary legal provision will be made in the amended Municipal Act, which is now under the consideration of Government.

Perhaps the most important event of the year in connexion with drainage was that in December the Corporation sanctioned the application for a further loan in order that an intercepting sewer may be constructed along the Queen's Road to join the new main sewer in Khetwady, with a view to prevent the discharge of sewage into Back Bay. The loan also provided for house connexions in the first drainage section and in Kamithipura, and for surveys for pipe sewers and house connexions in the Queen's Road district which constitutes the second section of the new drainage scheme.

Public
health.

The census of 1881 gave a population of 773,196, more by 128,791 than that enumerated in 1872. Taking local divisions we find that the largest increase is in Kamathipura. Taking class divisions we find that the low-caste Hindus give the highest percentage of increase. The importance of these facts in connexion with the death returns is self-evident. The fact that the proportional excess of males over females in the total population is considerably less than in 1872 may be accepted as evidence of the greater accuracy of the recent census.

The number of births registered during the year was 17,840 (16,638 living and 1,202 still-born). The number of deaths exclusive of still-born children was 21,856. In the previous year there were 18,500 births (17,247 living and 1,253 still-born) and 21,146 deaths. The increase in the number of deaths is described by the Health Officer as being "chiefly due to diseases of the respiratory system and to cholera." There is a marked diminution in the number of deaths attributed to small-pox, measles, fever, and phthisis. Comparing the number of deaths in several sections of the community for this and last year I find the following :—

	Number registered in 1880.	Number registered in 1881.
Hindus - - -	12,374	13,074
Hindu Outcastes - - -	1,554	1,694
Mussulmans - - -	5,154	4,907
Parsis - - -	888	977
Europeans - - -	195	238

The greatest number of deaths occurred in the Kamathipura sub-division, and the highest death-rate having regard to population was in Upper Colaba and in the Khara Talao (Nal Bazar) sub-division. Comparing the death-rate in the several castes or nationalities, we find the largest (leaving out of account Chinese and Negro Africans, whose numbers are so fluctuating that a correct percentage is unattainable) percentage among the Buddhists and Jains, a section which I imagine consists chiefly of Shravak Banias, and as they are a well-to-do class, the fact appears somewhat remarkable.

Vaccination.

The number of primary vaccinations was 18,591, as compared with 12,893 in the preceding year. It will be observed that the number of vaccinations exceeded the number of births by 1,953. It may be said that many of the vaccinations represent births of the preceding year, and this of course must be the case, but on the other hand many of the births recorded in the second half of the year will not be represented by vaccinations until the following year, so that this consideration will not ordinarily explain any great difference between the birth and vaccination figures. But there is no doubt that in the year under report the Act has been more strictly enforced, and the fact that the increase is especially marked in the earlier months of the year would warrant the inference that on this particular occasion an abnormally large number of the vaccinations

was on account of births of the preceding year. At the same time it is noteworthy that while the number of births and primary vaccinations among the Jewish community exactly corresponds, being 108 in each case, and that amongst the Parsis the difference is only 5 (births 1,325, vaccinations 1,320), we find amongst persons registered as Native Christians 1,005 vaccinations to 575 births, amongst Indo-Europeans 4 vaccinations to 85 births, and amongst Europeans 222 vaccinations to 178 births.

In connexion with the subject of registration I observe that the birth-rate amongst Indo-Europeans is shown as high as nearly 73 per 1,000. This and other apparent anomalies which are noticeable on a scrutiny of the statistical tables show that our registration system is still far short of perfection in details, if not in total results, and as long as this is the case no theory based on the statistics can be advanced or accepted with any complete sense of conviction. The Health Officer has alluded to improvements which we are endeavouring to introduce in the registration of deaths, especially with reference to a more correct assignment of death causes. We hope to secure a certificate in every case in which the person dying has received medical treatment, and in other cases to obtain more accurate information than at present, by employing a better class of men, men with some medical training, as Assistant Registrars at the burial and burning grounds. But even this measure is attended with difficulty, on account of the great number of places used for the disposal of the dead, and the hardship and inconvenience which might be entailed if many of them were closed. No amendment of the law with regard to the registration of births has been proposed, and hitherto the punitive provisions of the section relating to this subject have remained a dead letter. I think that on occasions they might be enforced with advantage, though only exceptionally and under strict supervision, but I should attach much more importance to any scheme which would increase the value of a certificate of birth. If, for instance, it were the practice to demand the production of a certificate from candidates for the public service, or to accept a certificate as conclusive evidence of the age of children employed in factories, the possession of these documents would soon acquire a value in the eyes of the people themselves, and a direct incentive would be given to a more accurate registration of births.

Registration.



ABSTRACT OF REPORT OF THE HEALTH OFFICER OF BOMBAY FOR 1881.

(*Surgeon-Major T. S. Weir.*)

Progress in
sanitary
work.

This year has been one of distinct progress—progress in continuous execution of sanitary works, and progress in strength and grasp of sanitary control—and advance towards the accomplishment and realisation of projects of vital and supreme importance to the public health.

It is to be regretted that the street drains already constructed in the first portion of a general drainage scheme are unusable and profitless yet, owing to connexions of buildings with the drains not having yet been made, although it must be stated that for the first time corporately the principle of house connexions or conduits between buildings and sewers or pipe drains for carriage of fœcal matter, has been acknowledged and sanctioned—experimentally, it is true, but still sanctioned and experimentally approved of; but it is also to be noted in connexion with this inexecution and non-completion of the first portion of the drainage scheme, 1stly, that in this year a further sum of Rs. 9,47,322 has been voted for the execution of further drainage works and operations embracing house connexions for sullage—provisionally and in the interval of experiments on privy construction; and secondly, of interest in connexion with the statement made in last annual report, namely, that the survey of buildings in the Kamathipura section had been completed, that Rs. 65,892 have been sanctioned for the completion and final execution of the drainage of Kamathipura—not the Kamathipura section of 64,658 population (which I regret), but the Kamathipura Proper portion of the section, of 28,455 people, a district, as previously described in some detail in annual report of 1879, the subject of an imperfect and abortive drainage experiment; and I may here make a mortuary statement of prospective interest, which is this, that the mortality in Kamathipura section is 206 less than in 1880; in 1881, 2,339 deaths are registered to 2,545 registered in 1880,—and I would now make mention of an important experiment in sewer ventilation (by shafts) which is to be primarily made in Kamathipura. It is to be regretted that house connexions have not been constructed, that the first portion of the drainage scheme has not been completed, and that therefore the advantages which are anticipated from a system of underground drainage on a European scientific model will not be reaped for some time.

The continuous execution of drainage sanitary works—progression in operations and measures for the improvement or amelioration of the public health or for the public convenience—has now become inevitable and cannot be avoided. The rapid growth of this great city has involved the responsibility of progression in measures for the protection and improvement of the public health; drainage operations must proceed synchronously with the expansion and extension of the city; the principle of drainage has been accepted, and the application of the principle will henceforth depend on the resources and opportunities of organisation, and the conquest of practical difficulties, and the adaptation of appliances to the instincts and habits of the people.

The sole responsibility arising out of the growth of the city is not confined to providing channels for the removal of the liquid refuse; when the drainage network has been completed the vital question of increasing the water-supply must be considered and discussed and decided also; for there is no doubt that the water-supply, with all appliances and measures recently adopted for improved and methodic distribution, is insufficient for the wants of the population at this time, and is still more insufficient prospectively. The population has increased 19·98 per cent. since 1872, and with the greater and increasing facilities for land and sea communication, while it is impossible to fix a limit for the future increase, it is not proceeding beyond the limits of rational speculation to conjecture, on the sound basis of the past nine years' experience, that the future expansion and growth of the city will not be less than in the past nine years; with improved and freer communication by land and sea, this city is in a different position to what it was with less freer communication in former years, and this altered position of the city must be distinctly recognised in shaping sanitary measures.

The expansion of the city has involved further responsibilities beyond the execution of sanitary engineering drainage works; with the execution of these works precaution and responsibility will not have ceased, and vital as these works are, they are indeed but a portion (a very important portion unquestionably) of other further measures that must be designed and carried out or enforced, and if these other and allied measures are not taken, then I must conscientiously say that in my expectation the extreme good possible and anticipated will not be realised; *great good will result*, life and health saving, but still the benefit and effect not to the extent possible or perhaps anticipated. I shall hereafter have to refer to the responsibility of preserving, in an effective and workable state, drainage works, more especially house connexions and conduits, after construction.

A further responsibility in regard to the insufficient provision of medical relief for the poor of this city has latterly become more apparent; of the total number of people who die in this city, but a relatively small number have received in their last illness any medical treatment or counsel, and moreover in serious illness the proportion of the necessitous population treated by skilled and qualified medical men is small, and in fact among the poorer classes, at that evil period when heavy sickness falls on them, when stricken down with illness and unable to go to dispensary or practitioners, the proportion who receive any medical advice—and by medical advice and treatment I do not confine advice and treatment to a qualification boundary, but I apply it to any form of trained and organised intelligent medical relief beyond mere incantation and spell—is but small. Medical relief.

The responsibility has become so manifest in regard to providing hospital refuge (beyond already existing hospital relief) in central positions for persons suffering from zymotic diseases, more especially cholera, that in this year I have suggested that five open hospital buildings should be erected in central positions, and kept ready for receiving persons stricken with zymotic diseases, or for those other sufferers who, removed from buildings by our orders, are homeless and can find no home. Estimates are being prepared of the cost of the erection of these buildings; they will not cost much, as they will be of light structure, and the more open they will be the better; simply open buildings are required; when there are patients to be admitted, partitions of a combustible and cheap nature can be put in, and when the period of emergency has passed away these partitions can be destroyed. No permanent establishment need be employed. The formation of hospital refuges has frequently been recommended before, but at this period the suggestion is more directly due to Dr. Pinkerton. But even the formation of refuge hospitals, such as I have suggested, will not lessen or alleviate the want (which, I think, is chiefly felt and chiefly to be relieved) of medical relief being brought to the poor, and being available at the homes of the poor legally demandable as a right. I refer rather to a system of poor law medical relief than dispensary medicine administration. In the time of sickness and prostration from sickness among the poor,—and these occasions must be very numerous,—when unable to go forth to seek for medicine, home medical attendance is necessary; there should be an official agency through which, as a right, the poor could have a medical man to see them, medical treatment brought to them at their homes, and I myself think it is rather a reproach that there is no system of medical relief for the poor of this city at their homes, and that there is no organisation through which the poor can secure, as a right, at their homes, medical attendance in cases of urgency and distress. I do not overlook, in making this statement, the free open hospital relief, but yet it cannot be concealed that residence in hospital is not in harmony with the instincts and sympathies of the people—that they, the people—the masses, like not to enter the hospital. If a system of home medical attendance, on the order and responsibility of members of the corporation say, in conjunction with the existing outdoor hospital and dispensary relief, was organised, a vast amount of suffering would undoubtedly be saved, and possibly a vast amount of life. I need not further refer to this important question of home medical relief, for the necessity of it will be generally at once admitted, and it has become more important and pressing latterly, owing to the increase of the labouring immigration: for instance by the census of 1872, the Mahrathce population was 86,589, and by the census of 1881 there are 120,184, an increase of 38·8 per cent. of these industrial and disease-susceptible (owing to condition of living and life-struggle) elements.

The population enumerated in 1881 was 773,196 to 644,405 by the census of 1872, an increase of 19·98 per cent. over 1872. Census of 1881.

On examining the tables before me of the sex distribution by the census of 1881, I observe that there has been a considerable decrease when contrasted with the census of 1872 in the preponderance of males over females; the proportion of males to each 100 females by the census of 1881 is 150·68 to 163·35 by the census of 1872; of each

100 of the population 60·11 are males against 62·03 in 1872, and 39·89 per cent. are females to 37·97 by the census of 1872.

The enormous increase in the Hindu low-caste population is of portentous import, and has the effect of exercising a powerful influence over the mortality; whatever sanitary improvements may be effected, the mortality of this city, with a population of 49,122 low-caste, assuming that their material and moral condition does not change, can never be so low as when the low-caste population was 31,347; 56·70 per cent. increase in the least healthiest elements is a terrible fact, and demonstrates how completely the sanitary position of the city has changed since 1872.

In every section except one there has been an increase of population, in some sections of extraordinary dimensions, and the expansion of population in the sections without the city proper is remarkable—a clear demonstration of the growth of the city within the last nine years.

Drainage.

I am glad to be able to state that the necessity of repairing the house connexions in Dhobi Talao has this year received attention. I have for some time been pointing out the deterioration and disorganisation of the house connexions made in 1872 in Dhobi Talao, and to urge that they should be restored and regularly repaired. I believe they have not been repaired at any time since their construction; they are corroding and breaking, portable portions being abstracted, and unless they are restored or repaired they will not only not perform the office they were intended to perform, but there will be no system of house connexions left in Dhobi Talao; and this section of the city, unless provided on another system, will be in a worse position than other portions of the city, for there will be a street exit of sewage. Refuse waters are seen lying on the sides of many of the streets, constituting a nuisance of some proportions; and, further, some houses built in recent years have not been connected on the system of house connexions of the district, and their sewage has a street side outfall and disposal not being able to flow into catch-pit reservoir, into which house connexions discharge; and, further, liquid refuse and water thrown on house gullies, not having passage to catch-pits, flows on to street sides through orifices in inter-house passage street boundary wall. The condition at this moment of the house connexions in Dhobi Talao is not satisfactory; the moral to be derived from their condition is clear, that the duty of the municipality in house drainage does not cease with construction of house connexions, when house connexions are made, an equal important duty, of constant supervision and repair, remains. It appears to me that the responsibility of keeping in a condition of effective repair, of maintaining the establishment required for constant inspection and repair of house connexions (for unquestionably an establishment will be required for this purpose if the works are to be kept workable, for there is not only actual wear of work, but injury and abstraction to be guarded against), has not yet been clearly realised, but it is a most serious responsibility and duty, and I would now earnestly raise my voice—not in alarm, but in warning—that unless an effective establishment is employed for the care of the drainage works, including especially house connexions, now being executed, not only will these works fail ultimately to some degree in their purpose, but from the public money spent on them the fullest possible benefit to the public health that may be derived will not certainly be derivable.

I have had in this year to ask a further consideration of the system of sewer ventilation, and to recommend that the ventilation of a number (a list of which I prepared) of sewers and drains should be improved. The expense of ventilating the smaller drains, although the necessity of improving the ventilation of these conduits is unquestionable, being heavy, and in the opinion of the Engineer greater than the probable good, the drains being so imperfect that they should be replaced by new ones, has caused the measure to be abandoned, but still I am glad to say that 56 manholes have been constructed in drains in 1881; the fact of this construction being necessary in 1881 is a cogent demonstration of the imperfect and dangerous condition of existing underground drains, and of the necessity for their reconstruction, and a proof of the exigency of improvement.

The drainage of the Fort (generally as a section) is very defective; the effluvia from the drainage of the southern portion of the Fort attracts most attention, as the roads are largely frequented and crowded thoroughfares, and possibly the emanations are more noxious owing to the drains in the southern portion having relatively fewer openings for foul gasses to escape from. I do not, however, think, notwithstanding its conspicuous offensiveness and disgustingness, that the drainage of the southern portion of the Fort is in a more defective condition and state than the drainage of the northern Fort section; the southern portion of the Fort has the advantage of some drains modern in construction, although these drains are imperfect in serving the purpose for which they were constructed, inasmuch as they have been built of proportions to carry rain water, and, further, they

are not a portion of tributary of the island drainage circulation. The drainage of the northern portion of the Fort is defective in every respect except one, viz., multiplicity of openings for escape of foul air or the admission of fresh air; in some streets there are openings at intervals of every 11 or 12 feet, and hence it is, I believe, that the old imperfect drains are less conspicuously offensive than modern-constructed drains.

The published death-rate does not faithfully represent the mortality in the Fort; it is reduced through the existence of elements and classes of prosperous vitality and other factors.

The attention devoted to the improvement of buildings in the previous year has continued. In new buildings I have demanded open spaces, of proportionate sizes, for ventilation; great good is being effected, which will be more apparent and evident hereafter; the lighting of buildings, the free admission of air, the freer access of light, have revealed dangerous forms of connexion between buildings (and, further, most dangerous, the bathing-niche in the corner of sleeping-rooms), and old covered drains; the full light and air making perceptible sewer emanations not perceptible before. I have had to bring to notice a good many instances of pollution of buildings by sewer air, and in some instances the sewer odours perceptible in buildings through direct and hidden connexion created a disgusting nuisance. But direct connexion of building and room with covered drain is not confined to the buildings of the poor; there are many fine buildings in the Fort (some of which Mr. Walton and I have inspected), which have house connexions constructed in defiance not only of the ordinary rational principles on which house connexions should be made, but in defiance of the instincts of common sense. What I have observed in this city leads me to think that the difficulty, when the first portion of the new drainage system has been executed, will not be to induce the people to make connexions with the drains, but the difficulty will be to prevent dangerous direct connexions being secretly made. An active danger to be guarded against is the ingenious and confident plumber.

A proposal for some time contemplated will be adopted this year—the co-operation of medical men and of the more reliable unqualified practitioners in detecting epidemic diseases will be asked. I shall distribute papers showing the shape in which information is to be forwarded to me; an important alteration in the Municipal Acts will if it becomes law constrain the reporting by medical men of epidemic types of disease which they may become cognizant of, and certain penalties for neglecting to afford information will be imposed.

Disease—
detection.

In this year there has been considerable discussion regarding the registration of deaths; I have written much on this question, and in this year I submitted a report exhibiting a scheme of registration; a portion of the scheme has been accepted, and the scheme has been considered in connexion with possible amendments in the municipal law, and possible concentration of places for disposal of the dead. The present system is not perfect, but it is not so imperfect in comparison with other systems in other countries as is sometimes conjectured. It is easily capable of improvement; it is simply a question of expense—whether it is the best possible expenditure of money having regard to other pressing needs; important alterations in the law have been proposed in the amendments to the Municipal Acts recommended, and if these amendments become law the scheme I have proposed will secure, in proportion to the completeness of its adoption, more perfect registration than at present; whatever system of registration may be adopted, exact information in regard to the causes of death is only possible with a wide system of medical relief.

Registration
of deaths.

The Vehar water-supply did not present any abnormal features beyond the excessive quantity of vegetable matter usually observed. The Tulsi water became very impure before the annual monsoon dilution, and towards the end of the year a dangerous amount of vegetable impurities in the water was observed. The construction of filter beds is proceeding.

Water-
supply.

The prosecution of cattle-stable owners, with the object of having buildings in suitable positions but unsuitable in construction improved in agreement with the bylaws, or buildings in unsuitable positions disused, has actively proceeded, and has led to a very considerable abandonment and emptying of cattle-stables in the city, and further led to some 700 buffaloes and bullocks being removed from the crowded city to vacant ground on the foreshore.

Improve-
ment of
cattle-stables.

The absence of any establishment for sanitary supervision of the Harbour has been receiving close attention. There is now, I hope, a near prospect of a Harbour sanitary staff being appointed.

Harbour
sanitation.

The former notoriety of Matoonga for guinea-worm has been recalled to memory this year in the experience of one village, and happily only one village, by name Gowaree.

Guinea
worm at
Gowaree.

This village has been dreadfully afflicted by this scourge; the villages on either side have been unafflicted. Gowaree draws its supply of drinking water from a well of muddy surface water about a mile to the east of the village; the villages on either side are supplied with Vehar water. Gowaree has been smitten, the villages on either side have been exempt. The sanitary condition of Gowaree is the same (except in water-supply) as the villages on either side; the most probable source of infection is the well water used by Gowaree villagers. The villagers have begged for Vehar water. I inspected the village more than once; the condition of the people was pitiable; there are some 40 houses and some 297 inhabitants; of the 297 inhabitants 89 were suffering from guinea-worm, and of the 40 houses people were suffering in most of the houses—a most distressing spectacle: one young woman with a child had 16 manifestations of filaria. In the village, out of 297 people (so far as I could ascertain), one had never suffered from guinea-worm. The people were poor, their sufferings increased the difficulties of life. The experience of this village recalls to mind descriptions of the condition of life from a sanitary view in years gone past in Matoonga.

Vital statistics.

Exclusive of still-born, 21,856 deaths were registered, a mortality 3,137 less than the mean of the previous five years, although it must be stated that the total number of deaths is greater than in 1880, the previous year, by 710 deaths, the enhancement being chiefly due to diseases of the respiratory system and cholera, diarrhoeal fatality, as would be anticipated, being in excess of the previous year; nevertheless the fever mortality is 1,076 less than in 1880, 2,483 less than the quinquennial mean; and moreover it must be stated, being a circumstance of an assuring and hopeful character, that the infant mortality under five years is 417 less than in the previous year, 1880. The death-rate, estimating for increase of population, is equal to 27·65 per 1,000 to a death-rate of 27·34 in 1880. Whilst the total death-rate of the city is 27·65, the death-rate amongst a large permanent and unfluctuating class of the population—the Parsee—is but 20·10, the incidence of the race mortality amongst the chief divisions of people fluctuates between 20·10 and 55·87; at one extremity is the Parsee population with a death-rate of 20·10, at the other extremity are Hindu low-castes, a large and increasing class, with a death-rate of 34·48.

The mortality according to race is very instructive. The variation in the incidence of the race mortality is not only a question of surrounding sanitary or insanitary conditions, potent factors as they are, but it is also a question of degrees of sustenance and mode of living and inner life. It appears to me that on observation of the divergent conditions under which large and distinct classes live, the true cause interpretation of the widely varying severity of the race mortality will be found.

Arranged according to death causes, the proportional mortality, calculated on the actual population of 1881, is shown in the following table; the decline in the mortality from fevers 3·34, and in phthisis 1·31 (although its import is affected by an increase of mortality from diseases of the respiratory system 1·85) will be observed.

Causes of Death.	Number of Deaths.	Ratio per 1,000 of Population.	—
Small-pox - - - -	35	0·05	* Annual increment of population is calculated.
Measles - - - -	192	0·25	
Fever - - - -	6,437	8·32	
Cholera - - - -	546	0·71	
Phthisis - - - -	2,232	2·89	
Diseases of Nervous System -	2,258	2·92	
Do. Respiratory do. -	3,799	4·91	
Diarrhoea - - - -	1,341	1·73	
Dysentery - - - -	721	0·93	
Accidents - - - -	371	0·48	
All other causes except still-born -	3,924	5·07	
Total - - - -	21,856	27·65*	

Small-pox.

Only 35 deaths were registered from small-pox, being 172 less than the last year, and 1,000 less than the quinquennial mean; the trifling mortality in this year must not be permitted to create a feeling of over-confidence and trust.

Fevers.

There has been a large reduction in the mortality from fevers; 6,437 deaths from fevers were registered, which is a mortality 1,076 less than the mortality in 1880, and 2,483 less than the average of the previous 5 years; 5,084 deaths were referred to remittent fever, being 1,780 less than the mortality in 1880, and 3,243 less than the

quinquennial mean. This is a very remarkable reduction in the mortality from remittent fever; in the previous year there had also been a fall of 989 deaths in the mortality from remittent fever. To simple continued fever 400 deaths were referred, to ague 942 deaths, and to enteric fever 11 deaths; the mortality from enteric fever simply indicates that so many cases were identified by medical men as cases of enteric fever.

In the first quarter the mortality from cholera was exceptionally low (in the year 1880 only 30 deaths were registered), 2 deaths occurred; in the second quarter, however, synchronously with cholera revitalisation in Western India, the disease acquired intensity in this city. The mortality had been progressively diminishing from July through August, September, and October, till in November it descended to 9 deaths; from the 27th of October till the 14th of November there had been no deaths from cholera; on the 12th November 3 cases were observed, but the disease did not become prevalent till after the first week in December. It is remarkable that 2 out of the first 3 cases on the 12th November had recently returned from the pilgrimage to Pandharpur; the third case occurred in Mahim. Cholera.

While in this year there has been no distinct concentration around particular sources of water-supply, there has been a distinct intensity of manifestation in particular districts and around particular centres of population; but the incidence of the proportional mortality from cholera and the total mortality from all causes has not fallen uniformly by sections; sections of the highest total mortality are not sections of highest cholera mortality; there are therefore apparently causes or conditions in particular sections favouring or predisposing to the growth of cholera; these causes have yet to be differentiated. The chief predisposing cause appeared to be of an individual personal nature, so to speak; undoubtedly an individual predisposition of constitution is a chief predisposing factor. The most uniform conditions I observed surrounding groups of cholera cases were, shortly, dampness,—dampness of ground,—of walls, imperfect ventilation and resulting air impurities; the exciting agencies of greatest potency, inasmuch as of most frequent occurrence, appeared to be dampness—humidity, which implies soil saturation and pollution arising from imperfect channels for removal of sewage—sewage stagnation and soil saturation and pollution being in the relation of cause and effect—air impurity and darkness arising from defective ventilation and lighting, dwelling and surface crowding.

In this year, as in every other period, cases of cholera, exceptional no doubt, occurred in good rooms in well-ventilated buildings, and in exceptional subjects. I was not able clearly to trace any cases to contaminated sources of water-supply.

The greatest mortality occurred in Phanaswadi, a section in which the disease appears to have been first revitalised or originated; the mortality is equal to 2·36 per 1,000; 55 deaths occurred, 52 of which took place in the second quarter. The conditions of unwholesomeness most evident in this section are foul drainage or no drainage, concentration of labouring and immigration elements, and house and room crowding. The drainage, in the sense of open channels for removal of sewage (for there is no system of underground drainage) of Phanaswadi is very imperfect—it could scarcely be more imperfect in a large city—and very bad, generally ill-constructed or unmade, irregular, and surface-leaking waterways and superficial cesspools; the greatest protection and safety to the public health from the imperfection of these channels being in their openness, in the facility with which their contents can be removed and their effluvia dissipated and destroyed. The district of second highest mortality is Girgaum, a district of equally imperfect drainage with Phanaswadi, of imperfect, ill-constructed or unmade open tracks for sewage channels or cesspools. The third highest mortality is in the Esplanade; in this section the severest fatality occurred in the third quarter, equal to 7·03 per 1,000; this severe mortality is due to Boree Bunder regimental lines and the municipal scavenger lines being in the Esplanade, and concentration of cholera incidence, occurring more especially in the regimental lines. The section of next greatest fatality is Mahim; in connexion with the mortality in Mahim and other sections undrained within and without the city, I would again draw attention to the absence of drainage in the outlying and moreover in many parts of the city itself. It is not a question (in many portions of the city) of which form of drainage is the best to be adopted: it is a question of any channels, however rude, to carry away the sewage from the dwellings of the people, so that the health of the population may not be tainted; in connexion with the mortality from cholera and other diseases in Mahim and other outlying portions of the island, I am glad to state that it is now in contemplation to extend the Municipal halalcore service to Mahim and the other outlying districts and over the island. Information is being prepared to

enable the organisation of an additional establishment of halalcotes being effected, the expense attending this measure having hitherto prevented its adoption.

The precautions taken were of a stringent, and in some instances of a severe and radical nature. Very stringent measures were taken in the shape of preventive and precautionary action. Over 500 persons were removed from buildings in which the development of the disease assumed a virulent form, and therefore a presumption of local causes and agencies which justified this severe measure. The tiles were taken off the roofs of buildings in other cases of less severity, and holes made in the roofs and sides of buildings so as to let in light and air freely. The earthen floors were dug up and sprinkled with carbolic acid, walls washed with a solution of carbolic acid or lime. The ordinary disinfectants were freely used internally and externally in infected buildings and in infected oarts, or gardens, which were also thoroughly cleansed.

Marked improvement has been effected in buildings in which cholera appeared. In a double chawl in Phanaswadi, already specially referred to, vast improvement has been effected; in the covered passage openings were made, the eaves cut, and the plinth of rooms raised; the chawls are now light and cheerful, formerly they were dark and wretched. In other buildings vast improvements have been effected; the opportunity has been taken of forming air spaces in the buildings. A class of building which was specially affected was that class of chawl to which so much supervising attention is given, and must be given, not only in regard to construction originally, but in regard to subsequent expansion.

As regards the mortality by districts, the highest mortality has been actually registered in Upper Colaba; the high death-rate in Upper Colaba is due to the fact of 26 deaths having occurred amongst Europeans of the military class passing through or resting in Colaba; deducting the 26 deaths the mortality is 31·39. I wrote to Dr. Codrington, in charge of the Staff Hospital, Colaba, in regard to the high proportion mortality amongst Europeans; this is Dr. Codrington's reply, and it is to me very interesting, and also of much suggestive value:—"There were 48 deaths amongst the military in Colaba during the year 1881, of these 22 occurred amongst those quartered in the station, and 26 amongst persons passing through. In the latter class were the seven deaths from measles. All persons who on the arrival of a troopship are too ill to proceed to their station in India, and invalids on their way home who are too ill to proceed to Deolali are detained here; hence during the trooping season there are always many cases of illness of the severest character admitted from others than those quartered here, and the mortality is very high. During the last two years *this has been higher than usual owing to the arrival of invalids from Southern Afghanistan.*

The mortality of the population in Khara Talao is therefore in reality the highest, 40·04. In reference to the high rate of mortality in this section, I have recommended that the open space of ground in Goolam Mohideen Street, in this section, should be purchased for a public garden, a place of wholesome recreation and exercise.

In the third quarterly report I drew attention to the high rate of mortality in Khara Talao, and suggested one form of public health amelioration; the mortality in Khara Talao in 1881 is, as I have before stated, 40·04 per 1,000, the actual number of deaths being four more than in 1880. Khara Talao is a section solely of underground drainage (drains or water-ways underground), the drains are square, imperfectly designed, imperfectly constructed; through the imperfections of design or construction, and time and age results, and altered building positions, and street levels, or the imperfect, badly constructed, unsystematically or wrongly designed connections drains flow not now freely—their circulation is retarded or obstructed, or even regurgitation in some instances is observed.

The population of Khara Talao has increased 21·37 per cent. since 1872; by the census of the year 1872 there were 8·40 square yards to each person, and by the census of 1881 there are only 6·93 square yards to each person—only 6·93 square yards to each person; the superficial room for each person in the section has diminished, while house accommodation and crowding has increased from 767 to 1,491; but sanitary measures, constructive or administrative, have not increased proportionately to the increase of the population. The district was fearfully overcrowded in 1872, it is still more fearfully overcrowded in 1881; there are many buildings, occupied by the poorest classes, of the most unwholesome construction—so constructed that no vital improvement is possible except through demolitions; these buildings are fearfully overcrowded, they are often of this nature—consisting of two double rooms, on one side communicating with a public passage or road, from which extending backwards, generally with no lateral open breathing passages, they have a gully (sewage flowing) exposure; these rooms are double, those in front are ventilated from passage, those in

back gully air-breathing ventilation; there may be one family—exceptional—or there may be more than one—most general.

There are other types of buildings for the poor, but not, I think, so dangerously constructed and disposed; there are some buildings in Khara Talao, occupied by shoe-makers and other outcasts, terribly crowded, fearful mingling of human beings, hideous pollutions. Improvements have been effected in many, yet in proportion to the total buildings, but few of the buildings in Khara Talao; in the new buildings constructed very great improvements have been made, but the improvement of the older long-lived buildings will be but gradual; improvement is taking place surely but gradually, and necessarily slowly; the section drainage requires to be reconstructed; these improvements are the more necessary inasmuch as there is a large wandering vagabond population, some in huts, most in buildings, and of the population 10·59 per cent. are outcasts. By the census of 1881 there were 340 homeless in this section.

A large number of persons living in Khara Talao are addicted to the excessive use of intoxicating drugs and associated vices; they become enfeebled apparently—lose energy and vitality. In 1872 the Health Officer thus referred to Khara Talao:—"I could conscientiously declare a great number of houses in this district as unfit for human habitation, but what is to become of the poor wretched tenants in the meantime?"

Further, there is in Khara Talao the great Moslem pilgrim resting-house; to this travellers' rest-house pilgrims, many of whom are in a feeble state of health, some suffering from disease, from all portions of Asia, come, and from here they go to the land of pilgrimage or return to their homes; around the rest-house pilgrims congregate, and in the streets pilgrims live; this pilgrim factor is no doubt a great element in swelling the Khara Talao mortality and also affecting the city mortality.

In the Kamathipura section 2,339 deaths were registered this year, being 206 less than the mortality in 1880; this reduction is a favourable sign; but the proportional mortality of Kamathipura proper is still high; the large, indeed fearful, proportion of low-castes in the population, 22·23 per cent., in Kamathipura proper must raise the death-rate relatively to a district in which there is a very much less proportion of low-castes. I hope the new system of drainage for Kamathipura will be completed in this year—1882.

With cholera prevalence there is, as would be anticipated, an increased mortality over a year of cholera dormancy such as the last, from diseases of the digestive system, more especially diarrhoea, while dysenteric fatality is less; 2,566 deaths from diseases of the digestive system were registered, being 202 more than the mortality of the past year, and 891 less than the mean of the past 5 years; 1,341 were referred to diarrhoea, being 607 more than the mortality of the past year, and 232 more than the average of the past 5 years; to dysentery 721 were ascribed—273 less than the last year, and 795 less than the mean; to all other diseases of the digestive system 504 deaths—132 less than in 1880, and 328 less than the mean. Local diseases.

The mortality from diseases of the respiratory system is 1,826 more than in the last year, and 1,678 more than the mean of the past 5 years; 2,175 were ascribed to bronchitis, being 1,140 more than the last year, and 1,177 more than the mean of the past 5 years; to pneumonia 1,027 were referred—150 more than the last year, but 19 less than the average of the past 5 years. It is possible that the increased mortality from diseases of the respiratory system may be due in some degree to meteorological phenomena; the greater prevalence of land winds must have the effect of increasing the prevalence of respiratory diseases, and there is the fact of factory labour influences, in their present extent and force, of recent growth, and therefore not yet estimated.

During the year 16,638 living and 1,202 still-born births were registered, against 17,247 living and 1,253 still-born births in 1880; of the children born living 8,675 were males and 7,963 females; the proportion of male to female births is as 108·9 to 100 females, the proportion in 1880 being 119·45 to 100. The sex proportional mortality in 1881 is in the ratio of 112·97 to 100. The birth-rate is equal to 21·51 per 1,000 of population. The number of premature births is 279, being 80 more than in the last year, and 174 more than the mean. Births.

APPENDIX.

No. 1.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER with the GOVERNMENT of INDIA for 1881.

Dr. Cuningham's Report for 1881 contains so large an amount of detail bearing on the sanitary condition of troops, prisoners, and the vast civil population from which data have been supplied, that it would be no easy matter to give a full account of its contents, but we shall take from it the more important points and practical lessons which it appears to teach.

The Report is divided into the usual 10 sections, the first of which contains Mr. Blanford's summary of Indian climates for 1881. Sections II. and III. deal with the statistics and sanitary history of British and Native troops. Section IV. gives the jail statistics. In Sections V. and VI. are discussed the vital statistics and disease history of the civil population. Section VII. treats of the general history of vaccination. Sections VIII. and IX. give a general account of sanitary works at military stations and municipalities, and the concluding Section X. contains general remarks on the year's proceedings. The Report is followed by a memorandum, drawn up by Dr. T. R. Lewis, on a cholera outbreak at Aden, and by the annual vital statistics of the European and Native Armies and jail population drawn up by Dr. Stephen, who appears to be a worthy successor to the late lamented Dr. Bryden; and by the combined labours of these statistical officers, Dr. Cuningham has been enabled to give a more complete statistical history of the Indian army than it has been possible to furnish in previous years.

1. We shall discuss the facts in the usual order, beginning with the vital statistics and sanitary history of the European and Native armies.

European Troops.—The following are the chief statistical facts under this head for the whole Indian Army:—

Strength, including troops in Afghanistan	-	58,728
Admissions to hospital	-	94,236
Average daily sick	-	4,095
Deaths	-	990
Invalids	-	2,241

These numbers reduced to ratios per 1,000, and including the Afghanistan troops, give the following results:—

	Per 1,000.
Admissions	1,604
Daily sick	69
Deaths	16·86
Invaliding	38
Total loss	55

The next abstract gives the ratios for each Presidency, but excluding the Afghanistan troops unless otherwise stated.

Armies.	Strength.	Ratio per 1,000 Strength.				
		Admission to Hospital.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
Bengal -	35,901	1,729	72	17·05	37*	54*
Madras -	10,891	1,160	60	10·97	28	39
Bombay -	9,895	1,784	72	13·44	53*	67*

* Including troops in Afghanistan.

2. It may be remembered that the Royal Commission on the sanitary state of the Indian army gave as a conclusion arrived at from the statistical records then available, that in past years, the death-rate among European troops in India had circulated round 69 per 1,000 per annum, sometimes under, at other times exceeding this ratio. Subsequently to the issue of their report in 1863 great and continuous improvements were carried out at many stations, and the death-rates fell in a very marked degree until, in 1877, the rate in India was no higher than 12·71 per 1,000, the lowest on record. About this time, short service and young ages began to raise the death-rate, and then came

the years of the Afghan war, which coincided with years of scarcity of food all over India, and at the same time men who had suffered in the field returned to the cantonments in India, there to raise the death and inefficiency rates. The influence of field service on the general health of the Army has nearly passed away, and the rates are again falling, as may be seen from the following data, which include the whole Indian army except troops stationed in Afghanistan in 1879-80 :—

Years.	Average Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1877 - - - - -	57,260	1,257	56	12·71	42	55
1878 - - - - -	56,475	1,651	67	21·46	45	66
1879 - - - - -	49,582	1,977	78	24·28	49*	78*
1880 - - - - -	51,796	1,789	74	24·85	26*	51*
1881* - - - - -	58,728	1,604	69	16·86	38	55

* Including troops in Afghanistan.

Troops in Afghanistan during 1881, consisted partly of contingents from Bengal, partly from Buobay. The strength in January was 3,837, and in December it was only 860. The average number was 2,541, and the inefficiency ratios per 1,000 were as follows :—

Daily sick -	-	-	-	71·6
Deaths -	-	-	-	51·55
Admissions -	-	-	-	968·10

3. We are now in a position to compare the 10 years' rates ending 1879 with those of 1880 and 1881 for the whole Indian European Army as follows :—

Periods.	Strength.	Ratio per 1,000 Strength.				
		Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1870-79 - - - - -	577,416	1,475	60	19·34	43	62
1880* - - - - -	51,796	1,789	74	24·85	26†	51†
1881† - - - - -	58,728	1,604	69	16·86	38	55

* Excluding troops in Afghanistan.

† Including troops in Afghanistan.

During the 10 years 1870 to 1879, the death-rate circulated round, not 69 per 1,000, but 19·34 per 1,000. The impress of the Afghan war is seen still in 1880, but in 1881 the death-rate shows a great reduction.

4. As nearly two thirds of the army are stationed in Bengal, a better idea of the facts will be obtained from the following abstract of its sanitary history for 22 years past :—

Bengal European Army.

Periods.	Annual Ratio per 1,000.				
	Admissions.	Daily Sick.	Deaths.	Invaliding.	Total Loss.
1860-69 - - -	1,755	67	29·98	41	71
1870-79 - - -	1,522	61	21·00	41	62
1880* - - -	1,818	75	27·73	22†	50†
1881* - - -	1,729	72	17·05	37†	54†

* Excluding troops in Afghanistan.

† Including troops in Afghanistan.

5. It is not necessary to repeat these comparative statistics for all three Presidencies, but the death-rates may be here introduced for all three to complete the history.

Armies.	Periods.	Deaths per 1,000 Strength.
Bengal - - - - -	1860-69	29·98
	1870-79	21·00
	1880*	27·73
	1881*	17·05
Madras - - - - -	1860-69	19·99
	1870-79	17·69
	1880	10·18
	1881	10·97
Bombay - - - - -	1860-64	22·61
	1865-69	20·48
	1870-79	15·27
	1880	30·90
	1881*	18·44

* Excluding troops in Afghanistan.

The data point to a steady reduction in the death-rates of European troops in each Presidency, but in Bengal and Bombay the temporary influence of the Afghan war is strikingly manifest in the great rise of mortality, now happily passing away with the war years.

6. We shall next give a brief analysis of the chief diseases and death causes, beginning with the statistical data for 1881, for the whole Indian European army.

Diseases.	Deaths.	Ratios per 1,000 Strength.	
		Admissions.	Deaths.
Cholera - - - -	137	3.4	2.33
Small-pox - - - -	1	.3	0.02
Enteric fever - - - -	155	5.6	2.64
Intermittent fever - - - -	4	581.5	0.01
Remittent fever - - - -	33	87.2	0.65
Continued fever - - - -	5		
Apoplexy - - - -	87	3.9	1.48
Delirium tremens - - - -	10	3.9	0.17
Dysentery - - - -	101	32.1	1.72
Diarrhoea - - - -	19	56.5	0.32
Hepatitis - - - -	94	31.9	1.60
Spleen diseases - - - -	2	5.7	0.03
Respiratory diseases - - - -	103	83.4	1.76
Heart diseases - - - -	32	—	0.54
Phthisis pulmonalis - - - -	44	7.1	0.75
Droopy - - - -	1	—	0.02
Scurvy - - - -	—	.5	—
Anæmia and debility - - - -	5	—	0.09
Rheumatism - - - -	—	4.7	0.31
Veneral diseases - - - -	—	260.5	
Abscess and ulcer - - - -	—	102.2	
Wounds and accidents - - - -	7	—	
All other causes - - - -	84	193.2	0.58
Suicide - - - -	34	—	
Died out of hospital - - - -	32	—	

In this enumeration the chief Indian epidemic to which in times past the most attention has been given, namely, cholera, occupies, as will be seen, a secondary position. The principal death cause of the year was enteric fever, a disease which is only one of the febrile group, and to show anew the importance of Indian fevers to Army efficiency it may be useful to give the actual admissions and deaths from each of these causes.

Diseases.	Admissions, 1881.	Deaths, 1881.
Cholera - - - -	199	137
Enteric fever - - - -	328	155
Remittent fever - - - -	921	33
Intermittent fever - - - -	34,149	4
Continued fever - - - -	4,198	5

The practical teaching of this table is that the efficiency of the army has a much more intimate relation to climatic, local, and personal causes of fevers than it has to epidemic cholera, and it follows that every effort should be made to eradicate fever causes, and if this view be acted on there will be less heard of cholera.

7. We have already stated the death and inefficiency causes for the three Presidencies, and we shall next analyse the Bengal data in order to localize the rates and to see where improvements are required. The following are the results for 1881 :—

Stations in	Average Strength.	Ratios per 1,000.	
		Admissions.	Deaths.
Bengal Proper - - - -	1,913	1,610	12.03
Gangetic Provinces and Oudh - - - -	7,401	1,741	15.94
Meerut and Rohilcund - - - -	3,819	1,867	17.81
Agra and Central India - - - -	4,252	1,728	10.11
Punjab - - - -	11,433	1,949	23.44
Hill Stations - - - -	4,816	1,177	9.97
Presidencies :—			
Bengal - - - -	35,901*	1,729*	17.05*
Madras - - - -	10,391	1,160	10.97
Bombay - - - -	9,895†	1,784†	13.44†

* Including depôts.

† Exclusive of troops in Afghanistan.

In a previous table we have given the army mortality as a whole for groups of years showing the great reduction in death-rates during the periods, and we shall next see in what diseases the mortality has fallen.

Dr. Bryden, in his "Statistical History" for 1876 (page 50), has given the admissions from cholera in regiments in their first year between the years 1864 and 1869 in Bengal as 18·7 per 1,000. The admissions during the 10 years period in the Bengal Army (1870-79) averaged 5·9 per 1,000. The admission-rate was the same in 1880, and in 1881 it was 3·4 per 1,000. There was thus a large reduction in the amount of cholera received for treatment, and the following abstract gives the death-rates for groups of years in each Presidency army.

Periods.	Cholera Deaths per 1,000.		
	Bengal.	Madras.	Bombay.
1860-69 - - -	9·24	—	—
1870-79 - - -	4·18	1·68	1·53
1880 - - -	4·84*	0·10	—
1881 - - -	3·28*	1·73	0·30*

* Excluding troops in Afghanistan and on the march.

This abstract shows how much less liable troops are to cholera in Madras and Bombay than they are in Bengal. That indeed Bengal Presidency has been the chief seat of cholera during the entire period, and that although a great reduction in the death-rate has taken place in Bengal, it is still about double the past rate in the south of India. One element in reduction of death-rates has however, been the falling off in deaths from cholera in Bengal to about one-half of their former amount, and to nearly one-third in 1881.

8. The next abstract gives the corresponding data for fevers:—

Years.	Death Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Enteric Fever.	Remittent and Continued.	Enteric Fever.	Remittent and Continued.	Enteric Fever.	Remittent and Continued.
1860-69 - - -	—	2·92	—	—	—	—
1870-79 - - -	2·28	1·74	1·42	0·62	1·75	1·14
1880 - - -	3·07	2·34	1·36	0·29	5·76	2·73
1881 - - -	2·62	0·70	0·58	0·19	2·83	0·91

The enteric fever death-rate in Bombay is greatly due to two or three stations. In the other Presidencies the fever-rates have fallen, but the figures show that much yet requires to be done at the stations.

We have separated these two disease groups as being more or less connected with local causes, but there are other diseases which have shown a marked reduction in death-rates of recent years. We have arranged these as follows:—

Periods.	Death-rates per 1,000.								
	Bengal.			Madras.			Bombay.		
	Apoplexy.	Hepatitis.	Dysentery.	Apoplexy.	Hepatitis.	Dysentery.	Apoplexy.	Hepatitis.	Dysentery.
1860-69 - - -	2·19	3·31	2·72	—	—	—	—	—	—
1870-79 - - -	1·53	2·04	1·37	1·42	3·16	2·32	1·56	1·71	0·98
1880 - - -	3·14	1·36	2·72	0·78	1·26	0·58	3·03	1·31	4·14
1881 - - -	1·75	1·64	1·00	0·96	1·54	1·15	1·21	1·52	1·82

These diseases, besides being connected with climatic causes, are largely influenced by the personal habits of troops, and taking the whole group of facts as they stand, and including the entire death-rates of the periods, there seems to be evidence to justify an opinion that the general management of troops, their better habits, and improvements at stations have all assisted in better health of late years.

9. These figures show the general results for the Presidencies, and the following abstract gives the reductions which have taken place in groups of stations in Bengal Presidency in 1881 when compared with the rates in the decade 1860 to 1869:—

BENGAL PROPER.

Districts.	Ratios per 1,000 Strength.			
	1860 to 1869.		1881.	
	Admissions.	Deaths.	Admissions.	Deaths.
Bengal Proper - - - -	1,821	29·57	1,610	12·02
Gangetic Provinces and Oudh - -	1,615	28·59	1,741	15·94
Meerut and Rohilcund - - -	1,576	26·61	1,867	17·81
Agra and Central India - - -	2,169	38·48	1,728	10·11
Punjab - - - -	1,741	25·24	1,949	28·44
Hill Stations - - - -	1,069	14·78	1,177	9·97
Bengal Presidency - - - -	1,755	29·98	1,729	17·07

It should be stated that the columns of admissions cannot be properly used for comparison between the years because of the large proportion of venereal cases which the admissions include. In the Bengal stations the venereal admissions numbered no fewer than 276 per 1,000 in 1881. The great admission cause at all the stations was malarial fever, and of the admission ratios for Bengal Presidency these fevers accounted in 1881 for 764 per 1,000 strength. The death ratios afford a better means of comparison, and these have all fallen in a notable degree except in the case of the Punjab, which in every way is now the most unhealthy region in India for British troops. Reduced death-rates have taken place at nearly all the 49 stations, including hill stations, in Bengal Presidency. The following are the exceptions. The data are for two decades :—

Stations.	Deaths per 1,000.	
	1860-69.	1870-79.
Fyzabad - - - -	20·1	24·9
Jullundur - - - -	15·19	19·2
Ferozepore - - - -	14·0	17·8
Dera Ismail Khan - - - -	11·8	17·1
Sialkote - - - -	11·2	17·9
Rawul Pindie - - - -	13·3	15·6
Attock - - - -	17·6	24·1
Nowshera - - - -	15·8	17·4

It ought, however, to be stated that the Fyzabad rate in 1880 was 11·20 per 1,000, and 6·12 per 1,000 in 1881.

It is obvious from these figures that at these Oudh and Punjab stations there has been a rise in the death-rates during the second decade, which calls for inquiry. There must be reasons for it.

The rise is not very great, but it is there, and may increase unless looked after.

On the other hand, there have been remarkable reductions of death-rates at other stations in the same districts.

At Meean Meer, for example, the death-rate during the first decade was not less than 70·4 per 1,000, and during the second 34·8 per 1,000. Peshawur, which during the first decade had a death-rate of 41·6, had a rate in the second decade of 28·5, but this 20 years' history has been broken in upon by the death-rate of 1881, which reached the great ratio of 84·08 per 1,000, of which 57·37 per 1,000 was due to cholera. The death-rate at Fort Lahore was 57·1 during the first decade, and 38 during the second. Allahabad, in the North-West Provinces, had a death-rate in the first decade of 48·6, and during the second of 20·9 per 1,000.

But the most remarkable examples of reduced death-rates are those afforded by stations in Bengal proper. Of these Fort William was in former times the most unhealthy spot in India, or perhaps anywhere else, for European troops. Its death-rate for 10 years preceding 1856 is given in the tables appended to the Report of the Royal Commission on the sanitary state of the Indian army at 102·35 per 1,000. Since that time great improvements in barracks, drainage, water-supply, &c., have been carried out, and in the decade 1860 to 1869, the death-rate was 25·19 per 1,000. In the following decade, 1870 to 1879, the deaths had fallen to 10·78 per 1,000, in 1880 the rate was 11·55, or ·77 per 1,000 higher, and in 1881 it was 4·32 per 1,000, a single year's exceptional rate no doubt.

Dum Dum had a death-rate during the first decade of 32·70 per 1,000, during the second of 15·33 per 1,000, and in 1881 the rate was 17·7 per 1,000. At Fort William the cholera death-rate averaged 8·85 per 1,000 in the decade 1860-69. It was 1·26 per 1,000 in the following decade. There was no cholera in 1880, and in 1881 the cholera death-rate was 1·08 per 1,000.

These examples will be sufficient to show that taken generally there has been a marked reduction in death-rates of late years, but that these rates have been liable to augmentation by wars, epidemics, and scarcity of food periods among the civil population; that the reductions have been most marked in certain districts; and that the military stations in the Punjab still require improvement. We shall next give a brief account of the principal death causes during 1881.

10. *Cholera*.—As already stated there were 137 deaths from cholera in the whole Indian Army in 1881, apportioned among European troops in the Presidencies as follows :—

Armies.					Total Cholera Deaths.	Cholera Deaths per 1,000 Strength.
Bengal	-	-	-	-	116	3·23
Madras	-	-	-	-	18	1·73
Bombay	-	-	-	-	3	0·30
Army of India					137	2·83

Of the 137 deaths, one took place on the march. Of 40 Bengal stations, seven had each a single death, two had three deaths each, two had four deaths each, and one had five deaths, one 13 deaths, one 17 deaths, and one station, Meean Meer, had 58 deaths. All the other stations, 25 in number, escaped the disease. Of 17 hill stations and depôts in Bengal Presidency a single death from cholera took place at Murree.

Of 16 stations in Bombay Presidency three yielded each a cholera death.

Of nine Madras stations only one, Kamptee, was attacked, and one station out of five in Burmah, viz., Thyet Myo, had four deaths. The facts appear to show that the cholera of 1881, so far as concerned British troops, was endemic in character.

11. The chief offender for many years, as regards cholera, has been Meean Meer, a station which was unfortunately formed on the site of an old Native cantonment, and it has been stated that wells and cesspits were both sunk in the same ground to the level of water-bearing strata. In the decade 1860 to 1869 the cholera death-rate at Meean Meer averaged 46·27 per 1,000. In the following decade it was 12·70 per 1,000. It escaped in 1880, and in 1881 the rate mounted up to 57·37 per 1,000 as already stated.

It requires no argument to prove that something very serious must be still at fault with Meean Meer, and if this cannot be discovered it becomes a question whether part of the station should not be removed to clean healthy ground. A similar remark applies to Kamptee and Thyet Myo.

12. The practical result of the history of cholera at stations of European troops is, that in the course of improvements at these stations a great reduction in the death-rate from cholera has taken place, but that the disease shows a tendency to periodical outbreaks at certain well-known stations. It is at these that special sanitary precautions should be taken, and if there are no known means of reducing the recurring mortality, the probability will be that the causes are topographical, and that there are such causes is well known in the history of cholera. The remedy in such cases is also well known, and this is simply leaving the locality.

13. *Small-pox*.—As is well known this epidemic disease prevails all over India, and fatal cases of it take place among European troops at stations in all parts of the country, but it never appears among them as an epidemic, and of late years the number of cases has greatly diminished.

Thus in Bengal there were in ten years, 1860 to 1869, 848 cases and 132 deaths from small-pox, giving a death-rate of 0·34 per 1,000 strength. In the next ten years, 1870 to 1879, the cases were 294, and the deaths 45, or 0·12 per 1,000. In 1880 there were seven cases and one death, and in 1881 there were four cases, none of which proved fatal. Corresponding data for Madras and Bombay commence with the decade 1870 to 1879, during which there were 55 cases and 10 deaths, equal to 0·09 per 1,000, among Madras troops. In 1880 there was a single case not fatal, and in 1881 there were nine cases and one death, or 0·10 per 1,000. The Bombay European army yielded 59 cases and five deaths in the same decade, a death-rate of 0·05 per 1,000 strength. In 1880 there were nine cases and three deaths, or 0·30 per 1,000, and in 1881 there were two non-fatal cases. It will be seen from these data that there has been a great reduction in small-pox attacks and deaths in the Bengal Army, while the amount of small-pox in the other two Armies has never attained so high a ratio as in Bengal, and there has been less room for reduction, but still the facts as they stand present points of interest, as they have all been supplied by vaccinated subjects.

14. *Fevers*.—Diseases classed under this head are by far the most important causes of death and inefficiency in the Indian European army. In 1881, out of an average strength of 58,728 men, there were the following admissions and deaths from different types of the disease :—

Fevers.					Admissions.	Deaths.
Enteric	-	-	-	-	328	155
Intermittent	-	-	-	-	34,149	4
Remittent	-	-	-	-	921	33
Continued	-	-	-	-	4,198	5
Total					39,596	197

These figures give for the whole European army an admission rate of 672 per 1,000 and a death-rate of 3·36 per 1,000.

15. The fever admission and death-rates were distributed among the Presidencies as follows :—

	Armies.	Ratios per 1,000.	
		Admissions.	Deaths.
	Bengal - - - - -	770·2	3·43
	Madras - - - - -	279·6	0·77
	Bombay - - - - -	844·8	3·74

The most important fever in this group is enteric fever, so far as concerns its fatality, next in order follows remittent fever, and the deaths from the whole fever group amounted to the loss of two companies, although the year 1881 was by no means a fatal fever year.

16. In so far as regards general inefficiency paroxysmal fevers are the most important. The data under this head include admissions to hospital, and also re-admissions.

The following abstract from a table in the Sanitary Commissioners Report shows the relative prevalence of fevers in the three armies during the last 12 years :—

Periods.	Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
1870-79 - - - - -	612·6	4·02	270·4	2·04	663·0	2·89
1880 - - - - -	818·3	5·73	452·7	1·75	1,128·8	8·99
1881 - - - - -	770·2	3·43	279·6	0·77	844·8	3·74

These data show that the amount of fever varies considerably, and as the local causes remain much the same, there is reason to believe that climatic elements, such as rainfall, moisture, temperature variations, are the causes which determine the amount of fever, and the only means of neutralising these influences is by drainage and by attention to personal habits among the troops.

17. It is different, however, with the death-rates, for as we have seen these are mainly determined by the amount of enteric fever at the stations. We have so frequently dealt with the question of paroxysmal fevers, especially in our " Suggestions for the Sanitary Improvement of Indian Stations " and their vicinity " (1882), where we have given the relative liability of troops to intermittent fever at every station, that we shall limit the present discussion to the question of enteric fever.

The report under review contains much information on this fever, but it is mostly of a negative character. It is not denied by any of the reporters quoted by Dr. Cunningham that enteric fever may be connected with sanitary defects such as local filth causes, impure water, tainted milk, and the like, but none of the reporting officers were able to trace the fever of 1881 to any such causes. In the words of the report applied to one of them, tainted milk, they appear to be " out of court." All we can do, therefore, is to analyse the present facts and see what they teach.

18. The following abstract gives the statistical history of enteric fever for the last 12 years :—

Periods.	Ratios per 1,000 Strength.					
	Bengal.		Madras.		Bombay.	
	Admission.	Died.	Admission.	Died.	Admission.	Died.
1870 to 1879 - - - - -	5·3	2·28	3·9	1·42	3·1	1·75
1880 - - - - -	8·7	3·07	2·6	1·36	9·5	5·76
1881 - - - - -	6·3	2·62	0·9	0·58	4·2	2·83

In discussing these data we must bear in mind that for some years the diagnosis of enteric fever in India was unsettled on account of the paroxysmal element in many cases, but we are afraid that in Bengal and Bombay the disease shows a tendency to increase. There has, however, been a decrease in the disease at Madras stations, and this fact is not due to transference of enteric fever cases under other heads, for the statistics show that in 1881 there was an absolute reduction in fever mortality.

19. If we assume the amount of fever as in some sense the result of atmospheric causes, we may be able to estimate the operation of these causes by ranging together the monthly admissions from intermittent fever with the monthly admissions for enteric fever for the whole Indian European army as follows :—

Months.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Intermittent - - -	2,179	1,709	1,892	1,704	3,022	2,435	2,544	3,376	4,140	4,331	4,471	2,346
Enteric - - -	15	13	28	32	56	83	21	37	28	24	24	17

There can be no doubt that these facts show great increase of intermittent fever during and after the rains when evaporation and variable temperature set in, but even making allowance for the smaller number of enteric fever cases, it can scarcely be said that the monthly proportion shows the same marks of the action of climatic causes as do the intermittent fever admissions. It would rather appear as if an increase of paroxysmal fever and of fever susceptibility also led to an increased liability to enteric fever, as part of the general fever history. It follows that, whatever may be the cause of enteric fever liability, it exists independently of climatic changes, except rise of temperature, which appears to increase the liability to attacks. On the evidence in the present year's report as it stands, we must therefore seek the causes of enteric fever prevalence elsewhere, and here we shall probably find a sufficiency of evidence to lead to practical conclusions, if we take into account not only the climatic and local conditions to which troops serving in India are exposed, but also the nature of the subjects exposed to their action, and these are healthy young men at periods of life when vitality is most vigorous, affording in these cases examples of many who, to all appearance, are the fittest for active life and its duties being cut off by enteric fever, while older men who have less life to spend, to a considerable extent escape its attacks.

Young ages are especially liable to fatal febrile attacks, so that the Indian experience is not singular, but there is this important difference, that, whereas among troops serving in the United Kingdom in 1880 deaths from fever (excluding eruptive fevers) were 26 per 1000, the fever death-rate among men of the same ages on Indian service, and excluding eruptive fevers, and in the same year was 6.51 per 1,000, in other words, for every man who died from fever in the Home army in 1880, no fewer than 25 died out of the same strength in India.

The losses from fever were less than in 1881, but this was an exceptional year, and below the average.

Out of this fever death-rate, enteric fever accounted for 3.63 per 1,000 in 1880, and for 2.64 per 1,000 in 1881. Statistical differences such as these frequently take place where both conditions and subjects are the same, and they do not invalidate the general experience that if a large proportion of healthy young men are sent to India, they will one way or another yield a much larger number of fever deaths than will men of more mature ages, and this well-known fact brings us to the question of ages in the Indian Army, and their bearing on its efficiency.

20. This subject we have discussed year after year, and we have long since arrived at the conclusion, that the way to keep up the fever death-rate in the Indian army is simply to fill up the ranks with short service young men. The subject is fully discussed by the Sanitary Commissioner in the present Report, and he has given the following table to show the gradual deterioration of the army in the matter of age:—

Year.	Under 25.	25 to 29.	30 and upwards.	—
	Per cent.	Per cent.	Per cent.	
1871 to 1875 - - -	38	27	35	= 100
1876 - - - - -	33	38	34	= 100
1877 - - - - -	33	35	32	= 100
1878 - - - - -	35	36	29	= 100
1879 - - - - -	39	33	28	= 100
1880 - - - - -	41	34	25	= 100
1881 - - - - -	43	35	22	= 100

Liability to fever is determined not only by age, but by length of residence in India, and the next table gives the constitution of the army under this head.

—	Percentage of Men to total Strength who have served in India two, five, and seven years, 1871-81.		
	Two Years and under.	Five Years and under.	Seven Years and under.
1871 - - - - -	36.2	64.6	78.9
1872 - - - - -	33.7	66.7	80.0
1873 - - - - -	31.7	65.5	79.6
1874 - - - - -	25.9	64.3	79.8
1875 - - - - -	26.1	60.1	81.0
1876 - - - - -	25.5	57.6	75.1
1877 - - - - -	25.2	56.2	72.6
1878 - - - - -	28.9	59.8	73.0
1879 - - - - -	32.1	60.9	72.6
1880 - - - - -	33.4	65.4	77.2
1881 - - - - -	38.9	70.4	81.1

It is clear from these abstracts that, while the numbers of men in the Indian army at the younger ages have been increasing, the proportion of short service men has also been increasing, so that what may be called the two fever elements, youth and brief residence, have been on the increase, and we shall next see what the results of both is on the amount of enteric fever.

Years.	Mortality from Enteric Fever and Ratio of Liability to it at different Ages.					
	Under 25.		25 to 29.		30 to 34.	
	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.
1877	2.45	44.2	1.55	27.9	0.99	17.8
1878	6.04	53.0	3.55	31.1	1.04	9.1
1879	6.17	54.1	2.78	28.9	1.78	15.6
1880	6.25	56.26	3.15	28.35	1.09	9.81
1881	4.56	59.84	1.57	20.60	0.79	10.37

It thus appears that the per-centage of younger ages has been increasing since 1877, the healthiest year ever attained to by the Indian army, as one consequence of the short service system, and that the liability to enteric fever, leaving out the exceptional year 1881, has been doubled or more for the younger ages. In 1877, the per-centage of ages under 25 was 33 per cent., and the liability to enteric fever was 44.2 per cent. In 1880 the per-centage of ages under 25 had risen to 41, and in 1881 to 43, while the per-centage of liability to enteric fever had risen to 56.26 and 59.86 in these years respectively.

21. The next tabular abstract shows the effect of residence on liability to enteric fever.

Years.	Mortality from Enteric Fever and Ratio of Liability to it at different Periods of Residence in India.					
	1st and 2nd Year.		3rd and 6th Year.		7th to 10th Year.	
	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.	Deaths per 1,000.	Per-centage of Liability.
1877	3.81	59.5	1.35	24.2	0.90	16.1
1878	7.90	68.4	2.64	21.2	1.38	11.0
1879	7.99	67.2	2.18	18.3	1.24	10.4
1880	9.08	75.98	1.78	14.90	0.47	3.93
1881	4.55	60.02	2.07	27.31	0.56	7.39

This table, with those that have already been given, can leave no doubt on the mind that, whatever may be the influence of local and climatic causes in predisposing to enteric fever, the subject, the young soldier, is the main death cause, and that to attain the highest enteric fever death-rate it is only necessary to send him to India and bring him back under the short service system. The statistical evidence would further appear to show that the lower enteric fever death-rates at older ages and longer periods of residence may be partly due to the dying off by fever of the more predisposed subjects in the earlier years of service.

The amount of fever and of fever liability will no doubt vary in some years, but with the present terms of army service this fatal fever will form an important item in the Indian army death-rates.

This is the result of long past, as well as of present experience, and all that can be done of a practical character is to try to diminish liability in young soldiers first landing in India, by having drill completed before landing in India, by exercising great care over the habits of these young men until they are accustomed to the climate, by placing as many of them as possible at hill stations, and by rigid attention to every local sanitary precaution. The need for this last recommendation appears to be shown by the fact that there are stations scattered all over India in all varieties of Indian climates and temperatures, at which the amount of enteric fever is much greater than at others. We have given a table, published in Vol. XI. of the India Office Sanitary Reports, giving the enteric fever deaths for seven years at all stations of European troops.

The stations at which troops are most exposed to attacks of this fever are Peshawar and Cherat, Neemuch, Meerut, Secunderabad, Bangalore, Lucknow, Fyzabad, Kurrachee, Nusseerabad, Hazareebagh, Mhow, and others. These names are selected to show that liability to this fever is not only general, by its almost universal appearance, but local, as shown by the number of deaths at certain stations.

22. In 1881, fatal cases of enteric fever occurred at 23 stations of European troops out of 39 in the Bengal returns, also at seven hill stations and depots out of 16 in the same Presidency. In Bombay and Madras, including Burmah and hill stations, enteric fever deaths took place at 11 stations out of 33, so that this fever took its victims from among European troops at 41 stations out of 88 in the returns. Of the 41 attacked stations 17 yielded one death each, 10 yielded two deaths each, and eight had three deaths. The largest number of deaths were furnished by Lucknow (13 deaths), and by Poona and Kirkee (10 deaths). But the deaths scarcely give a sufficient account of the facts. For example, there were 46 cases of the fever at Lucknow, 14 at Bareilly, 12 at Meerut, 15 at Rawul Pindi, 10 at the hill station of Ranikhet, and 16 at Poona and Kirkee. The disease was most prevalent at stations in the north-west of India, and it would appear as if some light might be thrown on this fact by examination into ages, temperatures, and local sanitary conditions at these stations. Lucknow is an old offender. Enteric fever appears to be endemic there, and the

cause of this fact has never yet been satisfactorily shown. All we can do is to call attention to the facts, and also to the circumstance that where enteric fever is connected with local causes it is not necessary that these causes should be of so prominent a character as to attract immediate attention. The continued action of not very evident cases may determine the occurrence of fever cases. In England filth at a considerable distance from barracks has led to fever cases.

23. In a previous table we have shown the past and present statistical history of apoplexy, hepatitis, and dysentery. Generally the mortality from all three has diminished, and no doubt the reduction will continue if spirit drinking be abolished, and the men take better care of themselves.

24. *Venereal diseases.*—These yielded an admission-rate of 260 per 1,000, as the result of 16 years' operation of Contagious Diseases Acts. The ratio was the highest on record with the exception of 1878. The Acts have failed in India to protect the health of troops from venereal diseases, and the whole subject is now under consideration by the authorities in India.

25. *Invaliding.*—We have already given the invaliding rate for Bengal as 37 per 1,000, for Madras at 28 per 1,000, and for Bombay at 53 per 1,000. The excess in Bombay is accounted for by the fact that a larger proportion of men are sent home from Bombay, for comparatively slighter causes than from the other Presidencies.

In Bengal the invaliding rate has fallen almost continuously from 50·41 per 1,000 in 1870, to 36·92 per 1,000 (including Afghanistan troops) in 1881.

In Madras Presidency the invaliding rate, which was 78·93 per 1,000 in 1870, was 27·91 per 1,000 in 1881, but, for the reason stated above, the invaliding rate in Bombay, which was 29·17 per 1,000 in 1870, was 53·35 per 1,000 in 1881, a rate which also includes the Afghanistan invalids.

As a whole, the invaliding has decreased with improved army health. The chief causes of invaliding were anæmia and debility, hepatitis, diarrhoea and dysentery, and phthisis. Young men under 25 years of age yielded 33·74 per cent. of the total number invalided.

The influence of new arrival on the death-rates was clearly shown in 1881. In the army generally the death-rate from all causes was 16·86 per 1,000, while among newly arrived regiments it was 23·64 per 1,000. And enteric fever, the death-rate from which in the army generally was 2·64 per 1,000, attained a ratio of no less than 10·65 per 1,000 in newly arrived regiments. As these regiments are composed mostly of youths new to Indian climates and conditions of service, we can easily understand why young ages suffer and raise the general death-rate.

26. *Women and children.*—In 1881 there were 3,741 women and 6,548 children at stations in India. The death-rate among women was about the average, namely, 25·93 per 1,000, and the death-rate among children was 60·17 per 1,000, also about the average. Of children's deaths no fewer than 55·57 per cent. took place under one year of age.

The chief death causes were:—

	Deaths.
Convulsions - - - - -	64
Diarrhoea - - - - -	53
Anæmia and debility - - - - -	41
Bronchitis and pneumonia - - - - -	41
Measles - - - - -	32
Dentition - - - - -	31
Remittent and continued fever - - - - -	28
Tabes mesenterica - - - - -	24

The total deaths were 394, and only two were ascribed to scarlet fever.

27. *Officers.*—The strength of British Officers in India was 1,532, among whom there were 26 deaths. There were 1,303 Indian Officers, of whom 14 died. There were besides 878 officers of both services out of India, among whom 30 deaths took place.

The death-rate of these 3,713 officers was 18·85 per 1,000. Four of the deaths in India were from remittent fever, and three from enteric fever. Six deaths were accidental, and one a suicide.

28. *Native Army.*—The average strength of the Native army in 1881 was 114,612 men. The admission-rate was 1,305 per 1,000, against a five years' mean of 1,422 per 1,000. The daily sick were 46 per 1,000, and the mortality, including absent deaths, equalled 22·62 per 1,000, or 4·78 per 1,000 under the five years' average.

The following were the chief admission and death causes during the year:—

	Admissions.	Deaths.		Admissions.	Deaths
Cholera - - - - -	208	111	Phthisis pulmonalis - - - - -	884	87
Small-pox - - - - -	116	12	Dropsy - - - - -	157	34
Enteric fever - - - - -	90	11	Scurvy - - - - -	903	27
Intermittent fever - - - - -	71,860	86	Anæmia and debility - - - - -	—	130
Remittent and continued fevers - - - - -	1,668	219	Rheumatism - - - - -	6,001	—
Apoplexy - - - - -	105	40	Eye diseases - - - - -	2,964	—
Dysentery and diarrhoea - - - - -	10,220	300	Venereal diseases - - - - -	4,526	—
Hepatitis - - - - -	257	19	Abscess and ulcer - - - - -	11,920	—
Spleen disease - - - - -	1,184	22	Wounds and accidents - - - - -	12,414	27
Respiratory diseases - - - - -	9,027	747	Guinea worm - - - - -	556	—
Heart diseases - - - - -	—	49	All other causes - - - - -	15,131	—

This tabular statement is not only of importance as showing the inefficiency causes in the Native army, but it gives the absolute diagnosis by skilled medical officers of the relative amounts of different diseases among a native population where the facts have been properly tested, and some of the facts revealed by it are worthy of notice.

29. For example, admissions for intermittent fever among Native troops born in the country averaged 627 per 1,000, while among European troops the average was 581·5 per 1,000. The strangers were less susceptible to Indian fevers than the natives. Again, the total fever mortality among European troops, 3·36 per 1,000, exceeded the mortality among Native troops, which was 2·76 per 1,000. But the enteric fever mortality, which was 2·64 per 1,000 among European troops, did not fall far short of the total fever mortality among natives. If we deduct the deaths from enteric fever, which is not specially an Indian fever, the rates would stand for Native troops about 2·75 per 1,000, and for European troops ·72 per 1,000, showing that except for superadded enteric fever European troops suffer a far lower fever mortality than Native troops. The Native army is much more liable to diseases of the respiratory organs than are European troops. In the former the conjoined death-rate from respiratory diseases, including phthisis pulmonalis, was 7·28 per 1,000, while among European troops the same conjoined rate was 2·51. In the European army the death-rate from hepatitis was 1·60 per 1,000, and from dysentery 1·72 per 1000, while in the Native Army the death-rate from the former disease was ·17, and from the latter, 1·30 per 1,000. Of the two most prominent Indian epidemics, cholera and small-pox, the European Army had a death-rate from the former of 2·33 per 1,000, and from the latter of ·02 per 1,000; while the cholera death-rate of the Native army was ·97 per 1,000, and the small-pox death-rate was ·10 per 1,000. Both armies are subject to rheumatism nearly to the same extent. The admission-rate from this disease among European troops was 47 per 1,000, and for the Native troops 52 per 1,000. But in no particular do the admission-rates vary so remarkably as in the case of venereal diseases, which furnished 39·5 per 1,000 among Native troops and 260·5 among European troops. These contrasts are very important, because they afford indications towards improving the health of both armies. Reduction of malarial causes would improve the health of both, but the Native soldier should be better lodged, and in both armies more attention is required in the matter of clothing, especially at night. Improved regimen and better habits would improve the health of European troops when in India, but enteric fever mortality must be reduced by sending an older army on Indian service.

30. These remarks apply to both armies generally, but when stations or groups of stations are taken, native stations and individual regiments present striking differences in death-rates, showing the influence of the locality and local climatic causes.

For example, the death-rate among Native troops in 1881 from respiratory diseases in the Gangetic provinces was 2·20 per 1,000, but in the Punjab the death-rate was 10·13 per 1,000, marking the influence of low and variable temperatures, and pointing to the need of suitable shelter and clothing to counteract the influence of climate changes.

Again, take the following stational death-rates in 1881,—Fyzabad 50·82 per 1,000, Nowshera 53·18 per 1,000. At Fyzabad the death-rate in 1880 was no less than 96·97 per 1,000. The mortality was chiefly due to malarial disease. Bengal Native troops serving in Afghanistan lost above 10½ per cent. of their number.

Take again a few of the Madras stations. Trichinopoly had a rate of 41·49 per 1,000 in the 6th Regiment there. The 14th at Dolunda had a ratio of 68·55 per 1,000, and at Rangoon the 11th had a death-rate of 49·50 per 1000.

In the Bombay Native army similar diversities in death-rates present themselves.

Taking the various divisions of the Native army, we obtain the following sick and death rates for 1881 :—

Presidencies.	Daily Sick per 1,000.	Deaths per 1,000.
Bengal Native Army - - -	52	23·84
Ditto, excluding Afghanistan - - -	51	19·76
Madras Native Army - - -	41	12·02
Bombay Native Army - - -	50	25·58
Ditto, excluding Afghanistan - - -	41	14·01
Central Indian Regiments - - -	26	12·11
Punjab Frontier Field Force - - -	55	17·95
Hyderabad Contingent - - -	24	7·78
India - - - - -	46	19·24

These ratios do not, however, represent the total deaths, for many deaths take place on leave. The ratios, however, show us the sanitary problems to be dealt with at the stations; in regard to which much useful information is given by the Sanitary Commissioner in a tabular summary of sanitary sheets from each regiment.

There are 224 of them, and they include nearly every possible sanitary defect in Native lines and quarters, differing of course in number at different stations, but including more or less bad hutting, want of ventilation, crowding, want of drainage, marshy wet jungly ground, pollution of ground by sewage, sleeping on the ground, and similar defects.

These disease causes are stated as facts, not as opinions. We are bound to accept them on the evidence of medical officers who have drawn up the reports, and in concluding these remarks on the Native army and its disease statistics, we would strongly advise that the facts regarding insanitary

condition which the Sanitary Commissioner has collected should be acted on at once, for it is not too much to say that, after years of professed improvements, no such statements should have been forthcoming.

31. *Jails*.—The average strength of prisoners in all the jails during 1881 was 100,844, distributed among 259 jails within the jurisdiction of the various Governments of India and Burmah. Among these prisoners the average number of daily sick was 4,529, or 4·49 per 1,000 strength; the number of deaths 4,440, or 44·03 per 1,000 strength. The following were the chief admissions and death causes during the year :—

Diseases.	Cases.	Deaths.
Cholera - - - -	564	306
Small-pox - - - -	92	8
Enteric fever - - - -	22	14
Intermittent fever - - - -	52,382	121
Remittant and continued fever - - - -	1,958	241
Typhus ? - - - -	329	60
Diarrhoea - - - -	9,851	728
Dysentery - - - -	9,145	978
Hepatitis - - - -	108	28
Spleen diseases - - - -	1,009	15
Respiratory diseases - - - -	5,667	690
Phthisis pulmonalis - - - -	584	271
Dropsy - - - -	501	181
Anæmia and debility - - - -	3,842	234
Wounds and accidents - - - -	6,087	66
Abscess and ulcer - - - -	15,394	—
All causes - - - -	122,400	4,440

This abstract shows clearly the influences direct and indirect, or secondary, of malarial locality and malarial conditions, the depressing effects of prison life and its surrounding, the influences of variable climate and temperature range, possibly augmented by want of suitable clothing to meet it, and adequate shelter in some cases to provide against cold night blasts, and possibly also inappropriate diet. But in so reading the statistics, the previous life, history, and conditions of prisoners, and their liability to similar diseases before committal, must clearly be kept in view, because unfavourable as the statistics unquestionably are (when we bear in mind that prisoners ought as far as possible to be exempt from special causes of high mortality), the disease and death causes themselves are precisely those from which the same people suffer often very severely out of prison.

32. The next abstract shows the strength and mortality for the last 10 years :—

Years.	Average Strength.	Deaths per 1,000 all Causes.
1872-76 - - - -	99,758	36·24
1877 - - - -	110,147	61·95
1878 - - - -	127,914	81·31
1879 - - - -	117,680	73·73
1880 - - - -	106,763	48·31
1881 - - - -	100,844	44·03

It will be observed that in this series the death-rates rose with the increase of prison population, and that the ratios have fallen with decrease of population. At first sight this fact apparently points to the effect of crowding more prisoners into existing prisons, and it would be condemnatory of this practice did we not know that 1877 and 1878 were years of famine and scarcity, the effects of which lingered among the population after food had become sufficient. From this point of view the health of prisoners appears to have followed the health of the outside population, so that the real question at issue is why the 100,844 persons of adult years and under control of educated officers present such high death-rates.

If we eliminate the famine year 1877, as representing not only prison mortality but famine results, we can distribute the death-rates as follows :—

Presidencies.	Period.	Average Numbers.	Deaths per 1,000.
Bengal - - - -	1872-76	68,328	39·03
	1878	78,116	65·85
	1881	63,478	44·42
Madras - - - -	1872-76	9,607	32·37
	1878	21,315	125·92
	1881	10,332	41·91
Bombay - - - -	1872-76	8,011	26·61
	1878	13,189	118·27
	1881	9,910	41·88

This abstract shows the influence of scarcity still prevalent in 1878 all over India, and also the special effects of famine in Madras and Bombay in the same year. There was a great influx of prisoners who committed offences to obtain admission and food, but during the third year after the famine the figures show that the prison mortality was resuming its normal amount.

33. The statistics of individual jails present the usual diversities. The lowest rate of the year was that of Dhulia jail in Bombay Presidency, in which out of 254 prisoners the admission-rate was 449 and the death-rate 3·94 per 1,000. In a considerable number of jails the death-rates can scarcely be called high, but there are instances in which rates are excessive; we shall only name those in which the death-rates exceed 10 per cent., they are as follows:—

Jails.	Average Strength, 1881.	Deaths per 1,000, 1881.
Midnapore - - - -	1,016	125·0
Dinapore - - - -	175	177·14
Soory - - - -	179	145·25
Nuddea - - - -	278	102·56
Bogra - - - -	185	102·70
Mymensingh - - - -	463	153·35
Chumparun - - - -	421	199·53
Purneah - - - -	180	107·69
Baraset - - - -	182	208·30
Darjeeling - - - -	89	123·60
Julpaiguri - - - -	108	277·78
Gorakhpur - - - -	638	130·09
Dharmasala - - - -	184	253·73
Lahore Central - - - -	1,964	157·33
Rawul Pindi - - - -	686	195·33
Peshawur - - - -	720	127·78
Thyet-Myo - - - -	400	167·50
Henzade - - - -	109	119·27
Tanjore - - - -	145	165·52
Trichinopoly Central - - - -	1,030	121·36
" District - - - -	153	130·72
Surat - - - -	209	138·76
Gokak Gang - - - -	461	112·80

Some of these most unhealthy jails contain only a small number of prisoners, among whom a death or two makes a tolerably high per-centage, but there can be no doubt that this record of mortality is a very sad one, and calls for earnest effort to abolish it. Besides the sick and death-rates each jail report is accompanied by an abstract of sanitary sheets sent in by the jail officers. The majority of these abstracts state distinct and specific sanitary defects, such as overcrowding, temporary overcrowding, defective drainage, bad or deficient ventilation, malarial surroundings, bad locality of prison, often suspicious or bad water, defects in latrines leading to nuisance, water-logged subsoil, defective clothing during cold season, jail diet complained of in one or two cases. These abstracts leave an impression that, admitting the necessity for sanitary works and measures so clearly pointed out in the reports, much might be done to remedy the existing defects by vigorous administration and oversight.

We are glad to learn from the Report that the whole subject has been placed in the hands of a special committee, who will doubtless go to the root of the evils, and propose remedies, and we must wait the result of their labours.

34. There are some remarks by Surgeon-Major James Reid in reference to causes of sickness among prisoners at the penal settlements of the Andamans and Nicobars, which are of much interest, as throwing light on the causes of malarial fevers in tropical climates, and also of bowel diseases. The fundamental facts are as follows:—

Convict Settlements, Andamans.

Years.	Average Strength.	Deaths per 1,000.	
		Dysentery and Diarrhoea.	All Causes.
1877 - - - -	9,089	5·20	34·30
1878 - - - -	9,571	17·13	69·79
1879 - - - -	10,075	6·75	47·54
1880 - - - -	19,916	14·57	49·65
1881 - - - -	11,225	15·86	48·02

In dealing with the causes of these death-rates, Dr. Reid says:—"There is no question here of improper or insufficient dietary, of want of attention to conservancy, of impure drinking water, or of deficient air, space, or ventilation. . . ."

"The great and permanent cause of sickness here is the malarial unhealthy nature of the stations on which convicts are located. . . . Of all causes of sickness here, this is the most important and far reaching in influence."

In Ross Island the death-rates have ranged between 8 and 21·3 per 1,000, but there is this important difference in this station as compared with the others, that "convicts living on Ross, though employed in hard enough labour and on exposed out-of-door labour for the most part, are not employed on certain forms of labour which men living on feverish stations have to perform—swamp reclamation, brick-making, lime-burning, &c. The worst results as regards health," he says, "are obtained when we have the three following conditions combined:—(a) exposure during the rainy season; (b) residence on a feverish station; (c) employment on swamp or jungle work or forest work generally."

Besides the production of fever, work of this class gives rise to ulcers, which have a tendency to become gangrenous; and, as usually happens, fresh clearings lower the standard of health of all living on them or near them. The following instructive data from one of the hospitals on Viper Island, which was formerly remarkable for its healthiness, shows the result of mangrove swamp reclamation on the adjacent main land:—

Months, 1881.					Fever Admissions.
January	-	-	-	-	87
February	-	-	-	-	72
March	-	-	-	-	51
April	-	-	-	-	45
May	-	-	-	-	204
June	-	-	-	-	207
July	-	-	-	-	284
August	-	-	-	-	190
September	-	-	-	-	247
October	-	-	-	-	217
November	-	-	-	-	352
December	-	-	-	-	192

Reclamation work commenced.
1st bund started.

Second bund started.

Rainfall, 15·27 inches.

35. Experience such as this has often been repeated, but it has generally been taken as a matter of course, although it is a part of sanitary practice so to conduct such work as to diminish the unhealthiness resulting from it. The subject was dealt with in the report of a commission sent to Algeria by the Marquis of Ripon, when Secretary of State for War in 1865-66, and in their report they give an account of the reclamation and draining of lake Hallula, during which about 34,000 acres of land were reclaimed. In the course of the work there was great mortality, as the people engaged in it had to work up to their middle in water, and to drink the muddy water of the lake. In the course of time it was found that providing good water, putting the workpeople away from their work, attending to diet, and stopping the works from June to December, diminished the mortality. "The older colonists in the neighbourhood agreed that although the first work of clearance and cultivation is invariably attended by fever, much of the sickness could be avoided by selecting the proper period for clearing and draining, namely, the colder season, leaving the land to be baked during the summer heats, previous to actual cultivation, and by sanitary precautions. These consist in avoiding commencing work till the sun has risen, the use of generous diet, careful selection of drinking water, good clothing, ablution and change of clothing after work, not living in close vicinity to the work itself, and frequent use of coffee. With these precautions they asserted that the clearance of waste land, and bringing it under cultivation, was not attended with serious risk to health." The preceding abstract of fever cases in Viper Hospital shows that the working time there is precisely the time which Algerian practice had shown to be the most dangerous. We have no means of knowing to what extent fever mortality, attributed to Indian jails, may be due to gang work conducted without precautions as to times and methods, and all we can do is to call attention to the experience, and at the same time to state the very obvious principle, that to employ prisoners in such a way as that they shall die of diseases produced by want of suitable precautions of the class we have named, is simply to add a death penalty to the sentence of imprisonment.

36. *General population.*—The year 1881 was the census year all over India, and the total population enumerated was composed of separated sexes, as follows:—

Males	-	-	-	-	123,211,327
Females	-	-	-	-	118,166,371
Total	-	-	-	-	241,377,698
Sexes not separated	-	-	-	-	11,005,512
Total population	-	-	-	-	252,383,210

A few other details bring up the census number to 252,541,210. But this total includes the population of Native States. The actual population of the 17 provinces was 218,559,918. Previous census enumerations had been made at irregular periods in different States, and according to these data the census numbers of 1881 showed an actual increase in population of these provinces of 12,788,565, or 6·2 per cent. The following table gives the details of registration in 1881:—

Provinces.	Population under Registration.		Deaths per 1,000.		
	Rural.	Towns.	Rural.	Towns.	Total.
Bengal - - - -	57,523,332	2,855,165	20·45	33·47	20·96
North-West Provinces and Oudh	41,369,081	2,738,788	31·39	37·80	31·79
Punjab - - - -	16,134,245	1,299,686	28·00	48·00	30·00
Central Provinces - - -	6,926,283	483,582	32·02	40·65	32·59
Berar - - - -	2,491,640	138,378	29·20	28·40	29·10
British Burma - - - -	3,277,784	414,529	14·25	27·43	15·75
Assam - - - -	4,425,692	58,013	15·95	23·46	16·04
Madras - - - -	27,178,076	1,498,299	15·80	22·80	16·20
Bombay - - - -	14,351,769	2,102,645	22·32	29·07	23·18
Mysore - - - -	3,933,411	252,777	17·06	16·24	17·02
Coorg - - - -	169,919	8,383	18·21	11·69	17·90

It will be seen that the ratios in this table set forth, not so much the actual facts as the state of registration in each province, but they also show that this important branch of sanitary work is gradually improving.

The next abstract gives the total deaths from the chief disease causes in these provinces for 1881 :—

Provinces.	Cholera.	Small-pox.	Fever.	Bowel Complaints.	Injuries.	All other Causes.
Bengal - - - -	79,180	24,371	940,911	57,029	21,655	132,332
Assam - - - -	5,010	3,129	42,553	9,865	934	10,450
North-West Provinces and Oudh	25,865	17,153	1,109,599	82,814	21,060	154,982
Punjab - - - -	5,207	6,749	355,279	17,281	5,695	129,568
Central Provinces - - -	9,140	1,816	143,933	22,133	3,957	60,488
Berar - - - -	3,404	225	41,681	11,951	969	18,431
Bombay - - - -	16,694	539	272,403	30,342	5,950	55,522
Madras - - - -	9,446	15,776	203,542	18,961	11,527	206,430
Mysore - - - -	25	2,566	43,842	4,844	1,094	18,869
Coorg - - - -	3	63	2,807	122	39	158
British Burma - - - -	5,239	1,766	27,743	8,808	523	19,057

With the addition of 2,499 deaths from cholera in Rajputana, Central India, and Hyderabad, the death causes for 1881 were as follow for all India :—

Diseases.	Deaths.
Cholera - - - -	159,213
Small-pox - - - -	74,153
Fevers - - - -	3,184,293
Bowel complaints - - -	259,150
Injuries - - - -	73,403
All other causes - - -	806,287
All causes - - - -	4,556,499

These numerical results are the best at present attainable, and such as they are, they show how very subordinate a part cholera plays in Indian death registration. Deaths ascribed to fever are by no means all due to this cause, for they include many inflammatory diseases.

Deaths ascribed to "injuries" included in 1881 no fewer than 22,377 deaths from snake-bites and wild animals.

37. As the disease history of each province has been discussed by us on other memoranda, it is unnecessary to enter further on this subject, except to notice certain points of cholera history, which have been dealt with by Dr. Cunningham in the present Report.

The first fact is one of considerable importance, and it is as follows :—

From a table given in the Report, it appears that while the total deaths from cholera among the civil population during the four years 1874 to 1877 had been 1,556,754, the total deaths during the four succeeding years, 1878 to 1881, had been 868,132.

The following is an annual abstract of this table :—

Years.	Cholera Deaths.	Years.	Cholera Deaths.
1874 - - - -	81,222	1878 - - - -	318,228
1875 - - - -	384,421	1879 - - - -	269,336
1876 - - - -	455,184	1880 - - - -	118,856
1877 - - - -	635,977	1881 - - - -	161,712
Total - - - -	1,556,754	Total - - - -	868,132

These facts correspond to the decline of cholera mortality in the army, and are not only hopeful, but the one agency which has been in operation at the same time has been attention to sanitary

work, which has been extending, and it is not unreasonable to connect this work with decline of cholera. We reported a year or two ago a municipal town in Madras Presidency, where cholera had been extinguished by cleansing and good water. Moreover, we have the experience of sanitary work at fairs as additional evidence, and it seems justifiable to press as strongly as we can for the advance of sanitary work in all towns and villages, as the only safeguard against this epidemic. This view, however, is not held as it ought to be by all persons charged with sanitary duties, and in the present Report Dr. Cunningham again calls attention to the interference of contagion doctrines with obvious sanitary work.

38. Some years ago the then Sanitary Commissioner for Assam explained the occurrence of cholera on board coolie steamers on the Brahmaputra by the theory of impure drinking water. It was never proved that the water then used was impure, nevertheless precautions were taken to secure perfectly good water for the coolies; but cholera reappeared, and this fact led to further inquiry, and it has been found that the amount of cholera among coolies has no reference to the water, but that it has a very distinct relation to the amount of cholera in the districts through which the coolies pass, suggesting that during the cholera period this passage should be avoided. The contagion theory imputed the deaths to some imported infection on board ship, and is suggestive of quarantine, regarding which Dr. Cunningham very properly remarks that, "when bodies of men have to pass through cholera infected localities, they should do so rapidly; any attempt at quarantining them in such a territory would be cruel."

39. When cholera was prevalent in Jullunder and its vicinity, the officer commanding put the cantonment in quarantine, which was countermanded by Government, and (instead of it) men were prevented going into affected places, and the cantonment "almost wholly escaped." In this case, had there been quarantine, it would, of course, have got the credit of this result.

Thyet-Myo is a cholera locality, and, nevertheless, to keep cholera out of it, the officer commanding wished to establish what was quarantine in reality against river steamers, a proposal which the Government very properly set aside.

In our memorandum on the report of the North-West Provinces and Oudh, we have discussed the great Mela at Allahabad in June 1882, and the cholera which appeared at it. An important question raised at the time was the extent to which the disease had been carried away by returning pilgrims. In the present report, it is stated that cholera prevailed extensively before the first case at Allahabad; but, as we have stated in the memorandum referred to, we must wait for all the facts.

40. Some points of interest are stated regarding the occurrence of cholera among European troops.

"At Meean Meer the weather is described as having been hot and cloudy. A sand-storm passed over the station at the period of outbreak, and there was also a little rain, followed by that peculiar and characteristic graveyard odour after early showers of rain in hot weather."

Is not this atmospheric state one of the results of subsoil pollution by long occupation of the site before a European cantonment was formed?

The following instance may be cited to show the evil of accepting postulates instead of facts in dealing with questions of etiology; it refers to a case of cholera at Jullundur:—"It is supposed that the infection was imported by the Royal Artillery dooly bearers, who slept in the verandah of the guard-room, under the window of the day-room where the prisoner was confined."

41. The Sanitary Commissioner has imported a new statistical element into the infection question, by calling for returns of the number of buildings in which cholera had appeared. Returns were received from 10,500 barracks, jails, asylums, &c., in 335 of which only did cholera appear. This is an extension of the village inquiry, and has led to similar results, namely, that a very small number of groups suffer, in the present case about 3 per cent.; but the number of cases differs greatly in different groups of buildings, as in the case of villages. The attacks in both cases are individual and local, and there is no spreading, as of a fire.

Further experience regarding liability of attendants to cholera attacks gives the following results for 1881, all attendants and cases, of course, being housed in cholera localities:—

Cases of cholera	-	-	-	-	-	861
Number of attendants	-	-	-	-	-	1,746
Attendants attacked	-	-	-	-	-	36

During the five years 1877—1881, out of 7,859 attendants on cholera cases, 149, or 1·9 per cent., were attacked. Seeing (as already has been stated) that all these people were in cholera affected localities at the time, this experience ought to counterbalance mere opinion on individual cases of supposed infection. The experience all shows the local nature of cholera outbreaks, and this view is further sustained by experience in moving troops, which appears to have been successful in arresting cholera in 1881. There is one exception at Meean Meer, which goes to prove the rule. We have already noticed the character of the site. In this case, "the first move was not successful, having been only a short distance from the barracks, but movements to a distance" (i.e., away from the site) "along the line of rail towards Mooltan, were attended with complete cessation of the disease;" and the necessity in every case of knowing the nature of the locality as regards cholera liability is proved by absence of satisfactory results in some cases at first, where the movement has been still within the cholera zone, and by the recurrence of cholera, in the Meean Meer example, twice over in moving again within the site, and the disappearance of the disease on return to camp. It would appear as if the question of cholera ought always to be considered together with the question of locality.

42. A discussion of another kind is raised by the Sanitary Commissioner on the assumed importation of cholera into Aden from Bombay by the "Columbian," which led to quarantine at Suez.

The facts appear to have been as follows:—

The "Columbian" left Bombay on the 17th or 18th July 1881, and the cholera history in Bombay city up to that time was as follows. There were no deaths in January or February. There were two deaths in March, nine in April, 68 in May, 85 in June, and 121 in July; August yielded 78 deaths and the disease declined. The greatest fatality in July took place in the first two weeks, as stated by the officer of health, and throughout the quarter, July, August, and September, he says, "the disease was generally distributed in small groups over the city." On 29th July a stoker on board the "Columbian" died of "colic," or while ill of "fever." Nothing further known about the case. Another of the crew had previously died on board, but the cause of death was unknown.

Three days after the first death the "Columbian" arrived at Aden. The ship remained a week there without any sickness on board; she sailed for Jeddah, where she landed pilgrims, and returned to Aden and Bombay without sickness. This vessel was one of multitudes of ships which have put in at Aden from India at all times and seasons, and when cholera prevails in all degrees of intensity there, without any suspicion of importation. Why then was the "Columbian" blamed for Aden cholera, especially as Aden has been visited several times with cholera without suspicion attaching to trading and passenger vessels? As we have stated the facts regarding public health at Bombay before the departure of the "Columbian," we shall state the corresponding facts about Aden before her arrival there.

There had been great mortality among starving Soumalis who had come from the African coasts. In June 1881 there were 161 deaths registered in Aden, against 89 in 1880, and 54 in 1879. In July the deaths rose to 209, as compared with 75 in 1880 and 64 in July 1879. The mortality was so high that Government attention was called to it, and a special inquiry had been instituted into its causes, which were for the most part dysentery and diarrhoea. In this state of public health the "Columbian" brought rice in bags, and as such a cargo could not introduce cholera anywhere, "the Committee are of opinion that some of the bags containing the rice cargo of the 'Columbian' had been tainted by cholera discharges at Bombay." This it will be seen is simply a postulate to enable the Committee to bring the cholera from Bombay, but there is absolutely not a shadow of proof to sustain it.

The case virtually ends here, but it is necessary to state what occurred afterwards.

On 1st August 60 coolies were engaging in discharging the cargo. On the evening of the 2nd, 68 coolies were thus employed. Next day, 3rd August, the port surgeon reported to the Political Resident that seven cases of cholera or of a disease closely resembling it had occurred amongst the coolies who had been unloading the cargo. On the same day two other cases among coolies took place, all living in the same village. All the attacked, except two, had been in the hold. These cases, it will be observed, took place within say 24 to 36 hours after presumed exposure to the cause. They took place in men living in Tawahi (Steamer Point). But there were other coolies engaged in the ship who lived in another village, Maala, and none of these were affected.

On the 4th August a Somali female was attacked at Tawahi without any communication with affected persons.

For a week after this there were no more cases, but on 12th August a Somali woman was attacked at Maala and died next day. This was the first case in the village. There were altogether 109 cases in this village, only five of which were among coolies; they took place mostly among women and children. There were only 35 attacks in males above 15 years of age.

The information in the Committee's report is very incomplete, and scarcely justifies any conclusions from it. But we are enabled to supplement it to some extent by the following facts about Maala, on which the force of the endemic fell, given by the Surgeon-General in his report on the Bombay Army. He says the insanitary state of Maala requires immediate attention. "The population of this village consists of the poorer and ill-nourished classes, and is being constantly increased by the arrival of destitute people from the mainland. The houses are reed and mat structures, each one having its cesspool, and there are large burial grounds not far off. As a consequence of this undesirable state of things, Maala is a place where contagious maladies usually originate and to which they cling longest." The Deputy Surgeon-General considers this place is a "standing menace to the health of the garrison."

At Tawahi, about which no information is given, out of 48 cases, 33 were adult males. But it has not been satisfactorily shown that the first case there had any connexion with the "Columbian," and he is not included in the list of men employed on board.

It is evident that in the way of coincidence there was an apparent relation between the arrival of the "Columbian" and the subsequent cholera, but in all evidence of this kind errors must be carefully eliminated, and before the coincidence could become of value it would be necessary to show that the striking exceptions to it were all applicable on the cholera poison importation theory, and then we should have to leave out the previous diarrhoeal sickness and death among the people, and the filthy state of the villages as probable exciting causes of cholera. The evidence, as it stands, must lead to a verdict of "not proven," and whatever opinion may be formed of this case, of one thing there can be no doubt, namely, that the "Columbian" did not go to Suez, and was not quarantined, and that the quarantining of other ships at Suez was altogether unjustified by the facts regarding the "Columbian" at Aden.

These Somali villages at Aden ought to be kept in a proper sanitary condition to avoid similar interruptions to commerce in future, or they should be removed.

43. Vaccination.—We have already given the total mortality from small-pox in India at 74,153 deaths in 1881. The details for each Government will be found in other Memoranda, and we shall merely introduce here a summary of results for all the provinces.

The vaccination establishment stood as follows:—

Sanitary Commissioners -	-	-	-	8
Deputy Commissioners -	-	-	-	14
Superintendents -	-	-	-	41
Deputy Superintendents -	-	-	-	81
Native Superintendents -	-	-	-	143
Vaccinators (average) -	-	-	-	3,445
Total vaccinations -	-	-	-	4,571,166

44. *Military sanitary works.*—The expenditure on military works in Bengal Presidency in 1881 amounted to 626,242*l.* Extensive additions have been made to the accommodation of British and Native troops at Baxa, Lucknow, Quetta, Rawul Pindi, Jutogh and Murree.

At Allahabad the question of providing an improved water-supply, both for cantonments and for the fort, has been under discussion and inquiry.

At Lucknow an estimate of 1,654*l.* has been sanctioned for draining cantonments, and certain drainage improvements were carried out.

At Benares improvements have been made in the Sadr Bazaar.

At Delhi water has been led to the Infantry lines, Duryagunge.

At Naina Tal, drainage, water-supply, and protective works have been in progress, and the late landslips have been removed.

At Chakrata a design for an improved water-supply has been prepared.

The water-supply at Umballa has been in progress, and 8,459*l.* have been spent on it in the course of the year out of a total estimate of 69,936*l.* Distribution works have been completed, so that the actual supply was about 210,000 gallons per diem.

Peshawar.—Water-supply was still incomplete, partly on account of imperfections in the works, such as failure in the dam, sinking walls of settling tank, erosion of the duct from too great fall. Ought not such contingencies to have been foreseen and guarded against?

The water-supply at Cherat was nearly completed.

The drainage at Quetta was under improvement.

45. *Cantonments in Bengal Presidency.*—A summary is given of the condition of 68 cantonments, abstracted from sanitary sheets received from each.

The strengths of European and Native troops are given for each cantonment, together with admission and death rates, and sanitary notes, showing the prevailing diseases and local causes.

To any one acquainted with Indian sanitary problems these returns must convey a large amount of information on the conditions to which troops are exposed. Accounts from different stations, of course, vary, but in the great majority of cases there are ample disease causes to be grappled with. The underlying disease cause everywhere, nearly, appears to be marsh miasm, connected with low, unhealthy, damp sites for lines, want of suitable drainage, and in many cases, bad water. There is nothing new in the experience, which fully bears out what we have said on malaria and its diminution by subsoil drainage in our "Suggestions for the Sanitary Improvement of Indian Stations and their vicinity," 1882. We have nothing to add to the recommendations therein made.

46. *Civil sanitary works.*—Most of the information contained in this section has been already dealt with in other memoranda, and need not be repeated here, except to state generally that much useful work appears to be in hand all over India, and which, if persevered in and extended, will assist in improving the public health.

47. *General remarks.*—So far as concerns sanitary progress among the Indian people, perhaps the most important paragraph in the Report under review is that which refers to the introduction of local self-government and its relations to sanitary work. It has been long known that although great schemes of works must be carried out by the Central Governments in each Presidency, the chief disease and death causes to be dealt with were those connected with towns and villages, where the details were so multifarious as to be to a great extent beyond the reach of any central administration.

The work of decentralisation will be first tried in the Central Provinces, where the Act "proposes the formation of local administrative areas by the aggregation of villages in circles and groups for the purposes of local self-government. . . . By giving over these matters, which embrace the whole range of sanitary works and improvements, to local management, there can be little doubt that the residents who are primarily to be benefited by these improvements will take an interest in them and bestir themselves regarding them in a way which they have never hitherto done." The experiment is a new one, and we must hope the best for it. The same principles it is intended shall be introduced all over India. In order to help with funds for sanitary work the local organisations will be relieved from police charges, "and all the advantages to be derived from the inspection and supervision of the officers of Government will remain."

In the meantime it is satisfactory to learn that to a certain extent the proposed changes have been successfully initiated. The Commissioner of Burdwan states that in some parts of the Serampore division there are very large and populous villages, among the inhabitants of which are many gentlemen of high intelligence and business habits "who have undertaken the office of *punchayet* under the village Chowkidari Act, and finding a very great demand and necessity for sanitary improvements in their villages have availed themselves of the influence acquired by their appointment to induce the villages to subscribe for such purposes. They have built culverts, made roads, and drained dirty places, all with funds freely contributed by the villages," but there are refractory people in these villages as elsewhere, and what is wanted is to confer authority on the officers to carry out the will of

the majority, and this would involve the principle of local self-government which it is proposed to confer on the localities.

48. Dr. Cunningham's Report is concluded by a short discussion on the plague disease of Mesopotamia, which is stated by the resident physician at Baghdad to be a malignant contagious continued fever, attended with glandular swellings. Such at least is the account given by people on the spot, but Dr. Bowman says that there are, in his opinion no conclusive facts to show that the disease was of a contagious nature.

Its attacks were local, and took place in damp, undrained, insanitary localities. It had never appeared on board ship.

Reference is also made to the requirements of the International Sanitary Boards in compelling the Indian authorities to quarantine arrivals from the Dutch possessions on account of cholera there, under pain of quarantining Indian ports, at many of which there are usually a few cholera cases. It should be borne in mind in dealing with questions of this kind that, if such proceedings are in any sense necessary, the necessity should be proved by facts which have actually occurred at Suez. Opinions or inferences are of no use in a question involving such immense interests. Ships which have had deaths from cholera on board are on the facts in a bad sanitary condition just as if they were infected cellars in towns, and might be made liable to the operations of the sanitary officer, but this is all that is necessary. To quarantine healthy ships can be justified by no reasons of past utility.

49. Lastly. From the review we have given of this Report, it will be seen that it conveys information of great public importance. It shows that the large expenditure for sanitary works at Indian stations has been repaid by a large reduction in death-rates among European troops; that the losses from cholera have been greatly reduced in the absence of all quarantine procedure in India, as well as those from other preventible diseases. But that the fever death-rate continues, and is likely to continue so long as the Indian European Army is so largely composed of short service young men, who carry with them into Indian climates and stations a liability to fever which is incidental to young ages everywhere, but is fatally acted on in India. Nevertheless the facts also show that fever liability is connected with locality, and that steps should be persistently followed to reduce the fever death-rate to something like an equality among the stations.

The great local fever cause, as is shown by the sanitary sheets for cantonments, Native stations, and jails is want of drainage of subsoils, damp bad sites, and similar conditions leading to a large amount of inefficiency from malarial fevers everywhere, and it follows that the chief direction which future sanitary work should take is in endeavouring to eradicate such fever causes from the soil of India. We have pointed out the methods of doing this work in our "Suggestions" already referred to.

Similar works are required for improving areas occupied by Native populations, as is shown by the enormous losses from fevers in all Indian Governments. As regards other disease causes in towns and villages, it is to be hoped that these may be dealt with by the new local authorities, and on the principles stated in our "Suggestions" of 1882. And we would call attention to the Aden coincidence as showing the necessity of careful attention to the sanitary condition of all Indian seaports, which is the only method to show that the infliction of quarantine on commerce is unnecessary.

It seems not unlikely, from facts stated in the present Report, that some at least of the high death-rates in Indian jails may be due to absence of suitable precautions in following outdoor work. This subject might possibly be considered by the Commission appointed on jails.

In conclusion, our acknowledgments are due to the Sanitary Commissioner with the Government of India, for the large amount of very useful and important information which he has been able to include in this admirable Report.

2nd July 1883.

No. 2.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for MADRAS for 1881.

1. The population of Madras Presidency on which the vital statistics of 1881 were calculated was that of the same year's census of districts and towns, which gave a total population of both sexes of 28,676,375. But there appear to be groups of population not as yet furnishing returns included in the official census of the whole Presidency, which was as follows:—

Males	-	-	-	-	15,242,122
Females	-	-	-	-	15,597,059
Total	-	-	-	-	<u>30,839,181</u>

Apparently the population used in the returns may be considered as nearly equally divided between males and females, but showing a slight preponderance on the side of males, as follows:—

Males	-	-	-	-	14,389,093
Females	-	-	-	-	14,287,282
Total	-	-	-	-	<u>28,676,375</u>

2. The year's births among this population were of—

Males	-	-	375,816 = 13·1 per 1,000.
Females	-	-	356,050 = 12·4 „
Total		-	<u>731,866 = 25·5</u>

This birth-rate is the highest yet registered, and its relation to the rate of the famine period of 1877 is clearly shown by the following annual ratios:—

Years.	Births per 1,000 of Population.				
1875	-	-	-	-	21·1
1876	-	-	-	-	21·6
1877	-	-	-	-	16·3
1878	-	-	-	-	11·9
1879	-	-	-	-	16·4
1880	-	-	-	-	22·9
1881	-	-	-	-	25·5

These figures, of course, include registration defects, and perhaps to a greater extent during 1877-78 than in the other years, but it is satisfactory to see that births are increasing, and that the registration of them is improving.

3. Deaths registered in 1881 were of—

Males	-	-	239,494 = 8·3 per 1,000.
Females	-	-	226,188 = 7·9 „
Total		-	<u>465,682 = 16·2</u>

These ratios are much below the truth, and it appears as if the reduction of mortality after the famine period had been attended by falling off in the registration. This is shown by the following death-rates passing through the famine time:—

Years.	Death Ratios per 1,000 of Population.				
1875	-	-	-	-	21·1
1876	-	-	-	-	23·3
1877	-	-	-	-	53·2
1878	-	-	-	-	27·8
1879	-	-	-	-	18·9
1880	-	-	-	-	15·7
1881	-	-	-	-	16·2

Birth and death ratios differ considerably in different districts, probably due to the state of the registration in each. In Madras itself, where the registration is under municipal management, the facts of the year were perhaps more correctly arrived at, and the ratios per 1,000 of population in 1881 were of births 40·6, and of deaths 38·3, but even these rates bear marks of being approximations only.

4. The number of deaths entered under the customary heads were as follows:—

Diseases.	Deaths.	Deaths per 1,000 of Population.
Cholera - - - -	9,446	0·3
Small-pox - - - -	15,776	0·5
Fevers - - - -	203,542	7·1
Bowel complaints - - - -	18,961	0·6
Injuries - - - -	11,527	0·4
Other causes - - - -	206,430	7·2
All causes - - - -	465,682	16·2

This death-rate of 16·2 per 1,000 compares favourably with the previous five year's average rate, 21·2 per 1,000, which, however, included the famine and scarcity years, but the facts, as a whole, tell against the registration accuracy.

5. We shall next discuss the facts of disease history under each of these heads, beginning with cholera, and the relation of the epidemic of 1881 to past cholera history as given by the Sanitary Commissioner in the present Report as follows:—

Years.	Deaths from Cholera.	Years.	Deaths from Cholera.
1866 - - - -	260,961	1874 - - - -	313
1867 - - - -	33,205	1875 - - - -	94,546
1868 - - - -	8,036	1876 - - - -	148,193
1869 - - - -	21,034	1877 - - - -	357,430
1870 - - - -	55,867	1878 - - - -	47,163
1871 - - - -	17,656	1879 - - - -	13,296
1872 - - - -	13,247	1880 - - - -	613
1873 - - - -	840	1881 - - - -	9,446

This abstract affords unmistakeable evidence of the essentially epidemic character of Madras cholera. Every year during the 16 years it has been present in some district of the Presidency. The cholera deaths registered in 1866 appear to have been those of a period of decline in a great epidemic, followed by another outburst between the years 1869 and 1872. Then came two years of comparative quiescence, followed by the great epidemic of the famine period, and it appears as if 1881 showed the beginning of another such epidemic time. It is necessary to call attention to this history, because there has been a disposition on the part of certain civilian officers to attribute the cholera of 1881 to a pilgrimage from which it is supposed, as a matter of opinion, to have been carried over Madras Presidency by returning pilgrims. The preceding abstract will be sufficient to enable any one to form an opinion on the probable influence of the pilgrim element, or, indeed, of any single known predisposing cause of cholera on the facts of the case. The point which concerns sanitary administration is whether there are any known methods of reducing the high predisposition to cholera attacks among the civil population, which these statistics show to be present, and which cannot be accounted for on any supposed transfer of the disease by pilgrims.

6. The next abstract shows the monthly prevalence of cholera mortality for the whole Presidency in 1881.

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - -	51	July - -	16
February - -	4	August - -	1
March - -	12	September - -	4
April - -	92	October - -	297
May - -	92	November - -	1,323
June - -	151	December - -	7,403

We have here evidence of two distinct epidemic outbreaks, the first ending in August with a single death. From this first outbreak there were 419 deaths, but the January deaths, 51 in number, were in reality, part of an irregular epidemic of the preceding year, during which there were three deaths in October, nine in November, and 219 in December. The same outbreak passed over to January 1881, and caused 51 deaths, as the table shows. The epidemic of 1880, and 406 deaths of the epidemic of 1881, all took place in the far north-eastern districts of Madras Presidency, which bound with the endemic area of Bengal. It is not of course alleged that this earlier outbreak was caused by the Tirupati festival, which took place early in October. It is fully admitted that cholera was moving slowly to the south from the Godavari region before the festival; all that is meant is, that such being the fact Tirupati festival was held and cholera appeared in a few cases among people who had been there, and, as the table shows a great outburst of the disease on and after October, it may be presumed that the spread of pilgrims from Tirupati was the cause of the great increase of cholera.

The facts in the preceding abstract appear, however, to show that, whatever may have been the influence of the pilgrim element, there was a real epidemic, obeying the usual epidemic law of increase, which would apparently pass over to the month of January 1882 to complete its period in that year.

7. We shall discuss the Tirupati case on other papers, but in the mean time we must ask the question, why there was cholera at this fair.

There are two Tirupatis, a lower and an upper. The lower town was carefully inspected by Dr. Price, Deputy Sanitary Commissioner, on 8th October, six days after the first case of cholera had taken place. It appears to have been in a fair sanitary condition. It was not there, however, but in upper Tirupati, that the disease broke out, and this is the place of pilgrimage into which the Sanitary Commissioner could not enter; he had therefore to content him such evidence as was at hand, and this is stated as follows:—"The hospital assistant seemed to me a most intelligent straight-forward man; he was quite certain that no one ill of cholera went up the hill. The accommodation on the top of the hill was insufficient and bad; the water, drawn from a sacred tank, used both for drinking and bathing, he described as being very bad."

Surgeon-General Dr. Cornish reports, "The general sanitary condition of upper Tirupati in regard to water-supply and conservancy and arrangements for the distribution of food appear to be very defective."

The sacred food "prasadam" was found on examination to be disgusting, "utterly unfit for human food, and likely to produce sickness if used as such."

These facts appear to be related to each other in the following order. The town of Tirupati itself in North Arcot had no cholera. No cholera case entered upper Tirupati, where the festival was held. This locality was in a very bad sanitary condition, but it lay beyond and out of the jurisdiction of sanitary officers. Out of 21 districts in Madras Presidency, cholera had appeared in six up to September, and North Arcot was not one of these. The deaths up to September had been 423 in number, the last four of which took place in Tanjore district in September. Here the first outbreak appears to have ended. But in October, 13 districts were attacked and yielded 297 deaths. These districts were scattered all over Madras, from Ganjam in the far north-east to Malabar on the far south-west, and from Bellary on the north to Tanjore on the south-east. As we have seen, the first case of this outburst took place on 2nd October. There was no communication of the disease to the town, and yet it is assumed that this wide distribution of cholera within the month was due to

pilgrims. But there can be no difficulty in accepting the following view of the matter given by the Surgeon-General, who says, "the epidemic visitation had been long foreseen, and authorities were "duly warned of its probable advent. The insanitary conditions abounding at upper Tirupati, no "doubt, had the effect of lighting up the disease," at least there, but there is want of sufficient evidence to show that "the dispersion of the pilgrims apparently helped its spread southwards," that is so far as being the means of conveying infection; otherwise, it is not unlikely that crowding of pilgrims into villages and towns may have acted as an added insanitary condition during the progress of a great epidemic outbreak, which covered more or less 18 out of 21 districts, and 109 registration circles out of 227. The deaths, however were due to a small number only of population groups, for all the cholera deaths of 1881, which amounted to 9,446, were returned, from 1,505 groups out of 47,325 in the Presidency. The facts as a whole scarcely ally themselves with the single Tirupati death, except in so far as this single death was apparently the first recorded death of the second epidemic of 1881. On one point, however, there appears to be no doubt, namely, that if this festival is allowed in future to be repeated, it ought to be on condition that the place should be thrown open like other festival sites to the sanitary officer and his work.

8. There are 72 towns in Madras Presidency, with a population of 1,498,299. Cholera deaths were registered in 36 of these, and were 2,220 in number. Ten of the affected towns had only one death each, but several of them suffered severely. Trichinopoly had a cholera death-rate of 9 per 1,000, Palni of 10.9 per 1,000, Arcot of 11.4, and Tenkasi of 12.2 per 1,000. Taken over the whole town population, the cholera death-rate was 1.4 per 1,000. The district rate on a country population of 27,178,076 was 0.2 per 1,000, or just one-seventh part of the town death-rate. One may well ask what the municipalities are doing.

9. There is only one special report on this matter, that from Salem, which in past epidemic seasons had sustained great losses from cholera. In 1881, out of a population of 50,713, there were 444 cholera cases, of which 130, or 2.5 per 1,000 of the population, proved fatal.

There are 5,312 villages in Salem district, of which 86 yielded 540 deaths from cholera, a death-rate of 0.2 per 1,000 against a previous five years average of 2.2 per 1,000. The death-rate in Salem town thus exceeded slightly the district rate of previous years, while it was above tenfold the rate of 1881. The first case in Salem town was in a policeman who had been in Salem for two months, and consequently had not been at Tirupati. He was attacked at drill on 11th October, and died the same night.

On the 7th October, a case of diarrhoea took place at Suramangalam station; it was treated on the spot, and went on by rail a few hours later. There is hence not an atom of evidence to show that Salem cholera was imported. The town in past times has suffered so much from cholera that the disease had come to be considered as endemic. During the epidemic of 1875, there were 840 cholera deaths. Of late years many important improvements in conservancy have been introduced, and the use of foul river water for culinary purposes has been forbidden. As soon as the first cholera case showed itself, the town was thoroughly cleansed and limewashed, and no doubt the lower death-rate of 1881 epidemic was partly due to active sanitary work.

The drainage has still to be undertaken, and a good water-supply has still to be provided. These two improvements must go hand in hand, and be completed before the town is comparatively safe, even, from cholera. But according to certain importation views stated in the Report, the cheapest reform would simply be to forbid the Tirupati festival in future, only we should strongly recommend the complete sanitary reformation of the town at the same time, or the authorities will very certainly have to account with cholera when it next becomes epidemic.

We shall revert to these local disease causes in a subsequent part of this Memorandum.

10. *Small-pox.*—During the last three years in the returns there has been a large reduction in the mortality from small-pox in Madras Presidency, and perhaps the best way to show this fact will be to give the deaths for the previous 11 years, as follows:—

Years.	Small-pox.	
	Total Deaths.	Deaths per 1,000 of Population.
1871 - - - - -	20,823	0.8
1872 - - - - -	39,074	1.2
1873 - - - - -	51,782	1.7
1874 - - - - -	48,843	1.5
1875 - - - - -	24,775	0.8
1876 - - - - -	23,469	0.8
1877 - - - - -	81,321	3.0
1878 - - - - -	56,360	1.9
1879 - - - - -	17,840	0.6
1880 - - - - -	14,529	0.5
1881 - - - - -	15,776	0.5

In 1881, small-pox deaths were returned from 199 out of 227 registration circles, but the proportion of attacked villages is not given.

The monthly prevalence of the disease in 1881 is shown by the following deaths:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	1,570	July - - -	1,078
February - - -	1,589	August - - -	1,056
March - - -	2,302	September - - -	975
April - - -	1,709	October - - -	927
May - - -	1,271	November - - -	1,098
June - - -	1,112	December - - -	1,239

Of these small-pox deaths, 1,047 took place in 49 towns out of 72 in the returns. The town death-rate was 0·7 per 1,000. In the country districts there were 14,729 deaths, equal to a small-pox death-rate of 0·5 per 1,000. The town of Madras yielded the highest small-pox rate of the year, namely, 4·1 per 1,000.

11. The successful vaccinations were 538,152, and successful re-vaccinations numbered 6,858 out of 10,541 operations of this class. The ratio of vaccinations is very small when compared with the population and birth ratios. These vary of course according to the accuracy of the registration in each district and the local activity of the service. Perhaps the best way of judging of the amount of work done will be simply to state the figures:—

Population - - -	28,676,375
Births, 1881 - - -	731,866
Successful vaccinations - - -	538,152

But the vaccinations refer of course to the whole population and not specially to the births.

The Sanitary Commissioner is quite aware that the results are unsatisfactory. He calls them "poor and miserable."

The vaccination establishment of the year stood as follows:—

Inspector of vaccination and Deputy Sanitary Commissioner -	1
Deputy Inspectors, 1st class - - -	30
" " 2nd class - - -	9
Vaccinators, 1st class - - -	236
" " 2nd class - - -	387
Probationers - - -	104
Peons - - -	33



The cost of each successful vaccination case was annas 4·9.

The chief improvement required in this branch of the sanitary service appears to be in the direction of greater extension among infants, for out of the total births stated above only 75,710 were vaccinated under one year of age, or 11·1 per cent. of the births, and out of 15,776 deaths from small-pox 3,357 took place under one year of age, 7,845 above one year and under 12 years of age, and 4,574 above 12.

12. *Fevers*.—As has been already shown, no fewer than 203,542 deaths were returned as due to fevers out of a total of 465,682 deaths. Any discussion in regard to fever etiology and history in Madras is hampered by a knowledge of the fact that fever diagnosis is very uncertain all over India. Nothing more can be done at present than merely to register the facts and see what may fairly be deduced from them. On this subject the Sanitary Commissioner has given a table showing the fever mortality in each of the districts of Madras Presidency for a period of 16 years, of which the following is an abstract:—

Years.	Fever Deaths.	Years.	Fever Deaths.
1866 - - -	110,102	1874 - - -	226,220
1867 - - -	112,511	1875 - - -	252,042
1868 - - -	105,692	1876 - - -	280,092
1869 - - -	182,846	1877 - - -	469,241
1870 - - -	151,027	1878 - - -	374,443
1871 - - -	192,469	1879 - - -	285,477
1872 - - -	214,148	1880 - - -	209,940
1873 - - -	222,848	1881 - - -	203,542

The sum of these columns of eight years in each gives, for the years up to 1873, 1,241,138 fever deaths, and for the subsequent eight years 2,250,997 deaths, not far from double the fever mortality, but the years 1877 and 1878 were the famine and scarcity years, and as such were exceptional, yet even if allowance be made for this circumstance we shall still have a very large augmentation of fever and its mortality to account for.

In 1881 every registration circle returned fever deaths, and no doubt every one of the villages, although the fact is not stated.

15. Taken by months the deaths were registered in the following numbers, and the average monthly rainfall at 233 observing stations is also given :—

	Months.	Fever Deaths.	Rainfall, Inches.
	January - - -	21,768	0.40
	February - - -	19,744	0.01
	March - - -	17,420	0.81
	April - - -	15,572	0.34
	May - - -	16,081	2.27
	June - - -	14,507	4.29
	July - - -	16,155	3.09
	August - - -	15,370	7.63
	September - - -	15,228	6.00
	October - - -	15,891	2.71
	November - - -	17,199	6.57
	December - - -	18,607	2.62

The average fever death-rate was 7.1 per 1,000, which was less than the previous five years' rate. This was 9.2 per 1,000, but it included the famine period.

14. When taken by districts fever death-rates show unexplained peculiarities which deserve notice.

For example, the fever death-rate in Tinnevely was only 4.4 per 1,000, while the previous five years' average was 5.1 per 1,000. The fever death-rate in Tanjore district was no more than 2.3 per 1,000 against a previous five years' ratio of 2.6 per 1,000. There are several districts in which the rates are somewhat higher, but more or less persistent, and then we have the following districts in which the rates are much higher:—

	District.	Fever Deaths per 1,000, 1881.	Fever Deaths per 1,000, 5 years Average.
	Nilgiris - - -	10.6	12.1
	Cuddapah - - -	11.4	20
	Vizagapatam - - -	12.0	11
	Ganjam - - -	12.6	11.7
	Kurnoul - - -	16.2	22.3

The facts appear to show that there are certain districts in which the fever death-rates are persistently low, while in others they are persistently high, although variable in both cases.

Fever death-rates in towns vary as much as they do in country districts. The low average in Tinnevely district extends also to the towns in it, in six of which it is under one per 1,000. There are very few towns in which the fever-rate exceeds 10 per 1,000, and the average rate for all towns is 6.4 per 1,000, while for country districts, as already stated, it was 7.1 per 1,000.

15. The facts taken as a whole point to the influence of local causes. But we may place side by side the monthly fever deaths and monthly rainfall in districts of highest and lowest mortality for purposes of comparison as follows:—

Months.	Kurnoul.		Tinnevely.		Tanjore.	
	Rain, Inches.	Fever Deaths.	Rain, Inches.	Fever Deaths.	Rain, Inches.	Fever Deaths.
January - - -	—	1,759	1.04	1,192	3.04	384
February - - -	—	1,516	0.02	793	0.02	409
March - - -	0.74	1,658	2.40	687	0.07	311
April - - -	0.29	1,254	0.41	590	—	365
May - - -	1.46	1,480	1.07	490	0.40	414
June - - -	4.38	1,126	0.15	483	1.16	417
July - - -	0.90	1,100	0.32	534	0.23	384
August - - -	5.54	932	0.82	514	4.07	345
September - - -	4.76	923	0.83	474	5.85	389
October - - -	1.86	942	3.45	507	2.34	415
November - - -	1.82	969	9.07	523	6.88	400
December - - -	—	1,238	3.42	731	17.10	427
Total - - -	21.75	Ratio per 1,000 16.2.	23.00	Ratio per 1,000 4.4	41.16	Ratio per 1,000 2.3.

The average rainfall of 233 observing stations for eight years was 46.95 inches, while in 1881 the fall was 36.74 inches, or above 10 inches under the average. For the whole of Madras Presidency this reduction in rainfall was attended, as has been shown, by a reduction of 2.1 per 1,000 in the fever death-rate.

In Kurnoul, the average eight years' rainfall had been 30.72 inches, and in 1881 it fell to 21.75 inches. The average five year's fever death-rate in this district had been 22.3, and it fell in 1881 to 16.2 per 1,000.

In Tinnevely district the eight years' average rainfall had been 26·08 inches, and in 1881 it was 23·00 inches. The five years' average fever mortality had been 5·1 per 1,000, and in 1881 it was 4·4 per 1,000.

In Tanjore the eight years' average rainfall had been 43·32 inches, and in 1881 it was 41·16 inches. In this district the five years' average fever death-rate, which had been 2·6 per 1,000, fell with the lower rainfall in 1881 to 2·3 per 1,000.

These examples will be sufficient to show the influence of rainfall on fever mortality. There is only one element in the tables which appears to have influenced the amount of fever, and this is the relative quantity of rain; but there is no sufficient proof that the rain distribution of the year exercised any decided influence on the monthly death-rates in any of the examples.

16. Among general fever causes in Madras Presidency must be placed the prices of food, but these could scarcely have influenced the general fever-rate of 1881, for the Sanitary Commissioner says, "It is gratifying to be able to record that the prices of food during 1881 in every one of the 21 districts are not only less than the average of the eight years taken before the famine, but even better than 1880."

The experience of the famine years has shown how fatal is the result of drought and food scarcity, followed by heavy rainfall, on the mortality from fever. These fever causes were absent in 1881, and the fever death-rate may hence be taken as showing the influence of ordinary every-day conditions existing among the population. Viewed in this light the statistics of fever already given show that without any other causes than those usually operating the fever mortality has been steadily rising, and it is with this element that the sanitary service must at present occupy itself.

17. Some years ago we suggested the possibility of facts of this class being connected with a cyclical law of malarial fevers. In subsequent reports received from India, this view was not sustained. Dr. Cornish, who was Sanitary Commissioner of Madras, considered that the facts might be explained by the existence of waves of malaria passing over the country; but the present Sanitary Commissioner, Dr. Furnell, does not adopt this view, while admitting, nevertheless, the gradual increase of fever mortality, which he appears inclined to attribute to atmospheric conditions. Unfortunately, the only meteorological element in the report is rainfall, the influence of which is amply illustrated by diagrams, but this, as we have seen, affords us no help in accounting for the facts. Dr. Furnell says that his own impression is, "that vicissitudes of temperature, which after all are comparative, have much to do with the production of intermittent fever. The natives of this country in their thin cotton garments, are exposed to rapid alterations of temperature, especially during monsoon months, and anyone who has had much experience in this country, especially as a medical man, must remember numberless instances where changes of temperature have been amply sufficient to induce ague. The most acute case of ague I ever saw was brought on in a young European officer, in previously robust health, from sitting a long time during the prevalence of the hot winds behind a well-watered kuskus tattie." (It can scarcely be said that this was a case produced solely by variable temperature.) Dr. Furnell continues as follows:—"I well remember that when Lord Napier first came to the Nilgiri hills, it was almost impossible to carry on the domestic duties of Government House, because all the Native servants were down with fever. The then residence of the Governor, Fern Hills, was thought to be malarious, but when flannel socks, shoes, more warm clothing, and charpoys to sleep on had been served out to the people the malaria disappeared."

The Sanitary Commissioner does not consider, however, that absence of these necessities of clothing is a direct cause of ague. The facts he cites have been long known, but they only amount to this, namely, that among people living in a country where diseases known as "malarial" fevers prevail, predisposition to attacks may be increased or lessened by neglect or observance of certain conditions not directly connected with the fever cause. No doubt there would be less fever if the whole Madras population was suitably lodged, clothed, and fed. But experience in other districts of India has shown that where malarial fever prevails with a certain degree of intensity it spares neither rich nor poor. Improved social conditions can alone supply the wants which Dr. Furnell has dealt with, and climate cannot be altered. We are thus shut up to dealing with local malarial causes in and around dwellings and the practical result of this discussion is, that the sanitary service and executive officers generally can only hope to arrest the increasing fever mortality by dealing with this aspect of the case.

So far as regards the fatality of ague, Dr. Furnell remarks that "this fever, as is well known, is not ordinarily, and need not be, fatal or even dangerous." And he attributes the great mortality from it to want of proper treatment, arising partly from insufficient medical attendance, but chiefly from Native superstitions in attributing fever to an infliction of their gods and goddesses which ought to be borne with and not resisted.

On the whole, therefore, the history of these fevers comes out tolerably clear in the present report, as well as the remedies, administrative and social, which have to be applied for reducing their amount and fatality.

18. *Bowel complaints.*—We have already shown that in 1881 there were two distinct epidemics of cholera, and by giving the monthly deaths from bowel complaints in the usual manner it will be seen that the two diseases had not the same statistical history.

There are 227 circles of registration, in 109 of which cholera showed its presence in some part of the year, while bowel complaint deaths were returned from 222 circles. This fact may show better registration, but when taken in connexion with the following monthly deaths, it shows that the two diseases did not prevail under the same law. The epidemic nature of cholera has been shown in a preceding table, but it will be seen that deaths from bowel complaints were more equally distributed throughout the year.

Months.	Deaths from Bowel Complaints.	Months.	Deaths from Bowel Complaints.
January - -	1,926	July - -	1,682
February - -	1,570	August - -	1,687
March - -	1,448	September - -	1,582
April - -	1,241	October - -	1,717
May - -	1,299	November - -	1,592
June - -	1,379	December - -	1,843

The total registered deaths were 18,961, equal to a death-rate of 0·6 per 1,000, against a previous five-years' rate of 1·1 per 1,000. Of the registered bowel complaint deaths 3,174 were returned from among 1,498,299 town inhabitants, a ratio of 2·1 per 1,000. There is no statement in the report on the probable causes of these diseases.

19. *Injuries*.—Deaths so registered are classed as follows for 1881 :—

Suicides - -	-	-	-	1,603
Wounding - -	-	-	-	977
Accidents - -	-	-	-	6,555
Snake-bite and wild beasts -	-	-	-	2,392
Total - -	-	-	-	11,527

Deaths from *injuries* exceeded the deaths from cholera by 2,081.

It seems unnecessary to discuss the disease history of the year at greater length, but we cannot conclude these remarks without stating that no more than 259,252 deaths have been included under it, and that we have absolutely no information as to the probable causes of 206,430 deaths, a number exceeding the whole mortality from fevers.

19. *Health of troops*.—The subject is connected in the present report with the condition of stations and sanitary works. We shall deal with the subject on other papers, and all we propose to do is to give the year's statistical data.

British Troops.—The strength of British troops for the year appears to have averaged 10,435. The admissions to hospital were in the ratio of 1,164·8 per 1,000, the daily sick averaged 68·2 per 1,000, and the total deaths 11·1 per 1,000. The chief admission causes were fevers, classed as follows :—

Fevers.	Admitted.	Died.
Typhoid - - - -	9	5
Continued - - - -	720	1
Remittent - - - -	51	1
Intermittent - - - -	2,100	—
Total - - - -	2,880	7

The fever death-rate of 1881 is the smallest on record, and may be compared with the numbers of fever deaths in the previous five years, which stood as follows :—

Years.	Fever Deaths.
1876 - - - -	26
1877 - - - -	24
1878 - - - -	26
1879 - - - -	24
1880 - - - -	16
1881 - - - -	7

There has been a great reduction in the deaths classed under the head of "typhoid fever." The preceding 13 years' average yielded 37 deaths per annum, and as we have seen only five deaths were so recorded in 1881. This reduction is not due to transference of typhoid fever cases under other heads. It arises from an absolute reduction, not only in fever cases, but in fever mortality. Enteric fever still caused five sevenths of the deaths, but as we have seen there were only seven fever deaths in all. A great increase of fever in the Madras European army took place in 1878, the year after the famine, and the subsequent fever history may be shown as follows. The numbers give the fever admissions for each year.

Fever Types.	Years.			
	1878.	1879.	1880.	1881.
Intermittent - - - -	1,598	2,617	3,396	2,100
Remittent - - - -	180	190	160	51
Continued - - - -	1,940	1,357	1,036	720
Enteric - - - -	7	12	25	9
Total - - - -	3,720	4,176	4,617	2,880

The facts bear out the view of the late Surgeon-General of Madras that of late years there had been an epidemic increase of fever in the army. But the question of classification appears still to be unsettled, for the Sanitary Commissioner states in the present report that "on reading over an abstract of cases, it is very evident that the entry to typhoid fever is only made when a case of continued fever assumes grave symptoms," and he recalls the fact he had formerly stated that fatal cases were entered as remittent fever, which after death had presented the usual pathological appearances of typhoid.

It appears, however, as if the fever history of 1881 had, to some extent, settled the controversy, because it has distinctly shown that the typhoid fever death-rate of the year is an independent factor in the history. But this conclusion leaves the question of diagnosis and its difficulties, whether at the beginning or end of the case, just where it was. Everything must necessarily depend on the diagnostic skill of the medical officer, and if he fails, it by no means follows that the disease does not exist.

The most satisfactory result of the discussion, however, is that 1881 has shown a large reduction of fever and fever mortality in the Madras army.

Cholera.—In 1880 there was only one case of cholera which proved fatal in the Madras army, while in 1881 there were 35 cases and 17 deaths. All the cases took place at two stations in Madras command and one in Burma. The numbers were as follows:—

Kampree	-	-	-	-	25 cases.
Secunderabad	-	-	-	-	3 "
Thyet Myo	-	-	-	-	7 "

Small-pox yielded eight cases, one of which proved fatal, all at Bangalore.

Hepatic diseases gave rise to 403 admissions and 16 deaths.

No account is given of the conditions under which these diseases took place.

There were 2,247 admissions from venereal diseases, of which 905 were for primary syphilis, 237 for secondary syphilis, and 1,105 for gonorrhœal affections. There were beside ten cases contracted on the march. It is not necessary to discuss this subject further at present.

20. *Native army.*—This army numbered 30,315 men on 1st January 1882, but only 23,314 of these supplied returns.

The disease and death-rates among these men for 1881 were as follows:—

Admissions per 1,000	-	-	-	948·7
Daily sick	-	-	-	44·6
Deaths in and out of hospital	-	-	-	16·2
Invaliding	-	-	-	47·0

The admissions to hospital were 22,119, of which 8,673 were for intermittent fever, yielding 38 deaths. There were 75 admissions, and 31 deaths from cholera. Of these, 24 admissions and six deaths were at Kamptee. Including British troops, Kamptee yielded 49 cholera cases, but the epidemic was more severe at Trichinopoly, where 39 native soldiers were attacked, of whom 18 died.

Small-pox yielded 33 admissions and three deaths among native troops. The year 1881, taken as a whole, was favourable to the health of both armies, but there were certain of the stations where they suffered so much as to show necessity for inquiry and improvement.

21. *Sanitary work at stations, towns, and rural circles.*—There is a large amount of detail on these subjects in Dr. Furnell's Report, chiefly derived from stational and municipal returns, and perhaps the best way of dealing with the subject will be to select the leading stations and population groups, and give the year's results as briefly as possible:—

Bangalore station. British troops.

Strength	-	-	-	1,389
Admissions per 1,000	-	-	-	1,180·7
Daily sick	„	-	-	74·1
Deaths	„	-	-	5·0

Drainage.—13,463 feet of drains constructed. Water-supply from Ulsoor tank principally, which receives the surface drainage of the station. "This is very objectionable." Of course it is, and it has been declared to be so for about a quarter of a century. The conservancy is done by the municipality on the dry-earth system, and the general sanitary condition was "good." The rainfall was 27·4 inches, against 51·49 inches in 1880; in which year all the disease rates were higher, but the drier year had more small-pox. New wells were dug, and 1,360 feet of roads were opened in the most crowded parts of the native town, admitting of improved drainage, ventilation, and conservancy. The town and station appear to be under the same committee.

Bellary station.

Strength	-	-	-	445
Admissions per 1,000	-	-	-	2,170·8
Daily sick	„	-	-	112·3
Deaths	„	-	-	8·9

Current sanitary work carried out; surface drainage requires improvement. The very high admission-rate included 1,174·4 per 1,000 from fevers, and 470·2 per 1,000 from venereal diseases. There was no cholera among British troops. But Bellary town yielded 116 deaths from cholera, 56 from small-pox, and 441 from fever. Its population is 51,766. It had a five years' death-rate of 34 per 1,000, and in 1881 its rate was 18·7 per 1,000. The drainage is described as follows:—"Un-
satisfactory both in streets and houses. Open shallow drains exist in the streets, and in the houses

there are cesspools." Otherwise the conservancy appears to be attended to, and 2,474*l.* were sanctioned for it. The cholera deaths are attributed to importation from Tirupati fair, without the slightest evidence, and in the face of this state of domestic drainage. The rainfall in 1880 was 16·2 inches, or 5·4 inches below the previous year's fall.

There are three circles in the Bellary district in which the drainage is passed into cesspits, and so into the earth. Their conjoint population is 1,781,869, and 884*l.* was allotted for conservancy, all of which was not spent. The water-supply is of the usual Indian character, and much of it not to be depended on.

Secunderabad Station.—

Strength	-	-	-	-	2,407
Admissions per 1,000	-	-	-	-	787·1
Daily sick	-	-	-	-	24·0
Deaths	-	-	-	-	15·2

Of the admission-rate 126·3 was due to fevers, and 306·2 to venereal diseases. Of the deaths among native troops seven were from fever, three from cholera, eight from dysentery, and one from diarrhoea.

The drainage of this important station is reported as much improved since last report, and a complete system was in progress of being carried out. Good water was scarce. European troops were supplied from wells. Cantonments and bazaars kept fairly clean, but the sewage is buried "almost in the bed of the dhobie's tank, to be ultimately washed into the Hussain Sagar tank." Courtyards of regimental lines require attention. Tirupati fair was held early in October, and has been made the scapegoat in many ill-kept places for imported cholera. In Secunderabad cholera appeared "towards the middle of the year." It "cannot be charged on this fair, but is reported as "having been imported."

Three non-fatal cases took place among European troops, and three deaths among Native troops. It prevailed in Hyderabad in August to November and caused 16 deaths.

The cholera among troops at Kamptee has been already referred to. This station, although in Madras command, is situated in the Central Provinces, about 10 miles from Nagpur. The average strength of European troops was 903. The admission-rate was 1,402 per 1,000, of which 612·4 per 1,000 was due to fevers, and the death-rate was 26·58 per 1,000. Of the deaths, 24 in number, 14 were due to cholera. The town of Kamptee has a population of 48,831, and is situated in a region where cholera prevailed as an epidemic in 1881. It broke out in the circle in July and lasted till October, and occasioned 116 deaths, equal to a death-rate of 1·7 per 1,000 from cholera. The disease appeared in July among the Native troops, 1,146 in number, and ceased in October, having in the period given rise to 24 attacks and 14 deaths. The first case among British troops took place in August, this case was followed by 22 in September, and 2 in October, 25 in all, and there were among European troops also 14 deaths. The death-rate among European troops was 15·5 per 1,000, among native troops 12·2 per 1,000, and in both conjoined 13·6 per 1,000. It appears to us that some account ought to have been given of the reason why troops, living under presumably better sanitary conditions than the native population, should have suffered an eightfold mortality? Under this head there is very scant information. As a rule, drainage is said to be "satisfactory" by natural nullahs, but, "on the occasion of heavy rains, portions of the cantonment get inundated owing to the "bridges on some of the nullahs being too small. This is an evil remediable, but very expensive." Now, in 1881, the rainfall was 71 inches against an average fall of 52 inches. The site itself is on low ground, and it is highly probable that there was inundation, and, if so, it is very likely that some of the wells supplying water for troops may have suffered. The usual conservancy operations appear to have been carried out. Any way this is one of the cases demanding very careful investigation and application of remedies. At the other less populous stations the usual sanitary work appears to have been more or less carried out, and there is nothing in the abstracts specially calling for notice.

22. *Municipal Towns.*—There are 47 of these which make returns of work and expenditure. Their population in 1881 was 1,216,198. Their total estimated income for 1881–82, was 147,234*l.*, of which 31 per cent. was allotted for sanitary purposes. The total amount expended in the period by 45 towns making returns was 24,444*l.* for conservancy; for water-supply improvements in 39 towns making returns the expenditure was 1,926*l.*, and 16 towns reported the expenditure of 3,206*l.* for town improvements. As in previous years, the amount allotted for sanitary work, namely 45,676*l.*, exceeded the expenditure, which in 1881 was represented by a sum of 33,470*l.* Under the year's expenditure was included 243*l.* for sanitary measures at fairs and festivals, 1,750*l.* for markets and slaughtering-places, and 3,648*l.* for latrines, dust-bins, &c. It is satisfactory to see that the expenditure details bear a certain resemblance to those at home, but the amounts appear to be woefully deficient when we take the local necessities into consideration. It is, of course, impossible to form a judgment as to the efficiency of the work done, unless we accept the death-rates as evidence, and, according to the tables, these rates, which on a previous five years' average yielded 26·6 per 1,000 for all the towns, had fallen in 1881 to 22·8 per 1,000, but apparently both ratios are too low. Of the figure reduction there can, however, be no doubt. Under this head we may again cite the case of Guntūr, which has for a number of years been under active municipal improvement. Its five years' average death-rate has been 20 per 1,000, and in 1881, it was only 12·7 per 1000. It had not a single death from cholera or small-pox, and its fever death-rate was only 2·5 per 1,000. In this case, effectual work was done, and it is probable that the municipal authority had sent in accurate returns. Sanitary work has also been extended beyond the town, for in Guntūr circle "fifty towns and villages "enjoy the privilege of having conservancy establishments, who keep the streets, &c. clean. The "sweepings from these are collected and sold by auction."

The town of Salem, already referred to, has undergone some improvement of recent years. The use of river water for drinking and culinary purposes has been put an end to, with apparent advantage during the late cholera. The town is kept clean by an establishment of sweepers. Public latrines, 58 in number, have been provided; new wells and water sources have been opened, but the drainage passes by flat, unpaved, open cuts "to catchpits or cisterns on the river banks, the contents of which are removed by handpumps and carried away in barrels." It is, of course, perfectly right that, in the present state of drainage and water supply, the cleansing should be actively and unceasingly supervised, but the arrangements can scarcely be considered as sufficient for a town of 50,000 people.

Trichinopoly.—This town, with 75,306 inhabitants, had 678 cholera deaths. It is undrained, and sewage is passed into house cesspits. In certain parts of it intermittent fevers prevail. The town has been surveyed for drainage, "but the cost is so great (amount not stated) that the Commissioners cannot see their way to its completion." Unfortunately, cholera takes no cognizance of the cost, and raises its own inevitable tax.

23. *Local Fund Circles.*—Returns were received from 31 circles, containing the rural population of the Presidency. In small country population groups most of the required sanitary work, namely, cleansing, and protection of water sources, should be done by the people, but there are cases where work of this kind has to be paid for, and the following abstract will give a general idea of its nature and extent.

Nature of Improvements.	Amount sanctioned.	Amount spent.
	£	£
Conservancy - - - -	17,410	11,164
Improvement of village sites - -	4,264	551
Water supply and repairing - - -	10,849	5,124
Construction, &c. of tanks and wells		
Latrines, dust-bins, &c. - - -	4,890	2,615
Markets, &c. - - - -	9,449	3,411

The population of these local fund circles in 1881 was 28,617,226. Their total available income (one third land cess) was 135,139*l.*; of this amount 28·7 per cent. was allotted for sanitary purposes, and excluding the amount spent on markets, the sum available for real sanitary work among all these millions of people was no more than 38,695*l.*, of which only 20,154*l.* was spent, and the chief items are given above. We wish that the fall in death-rates in these rural circles from a five years' average of 21·1 per 1,000 to 15·8 per 1,000 could be accepted as proof of better health following on real work done, but with the facts given in the tables, showing the amount of epidemic disease included in the death-rates, this view can scarcely be accepted, for it is highly probable that with better registration the death-rates would rise.

The summary of expenditure given above sufficiently indicates the class of improvements for these local fund circles, but a few particulars may be added to show the extent of work required.

Water-supply.—The principal sources of water-supply are tanks, wells, rivers, and irrigation channels. In most cases these sources are not protected, and are used indiscriminately for all purposes, including washing of dirty clothes and persons.

Drainage.—Generally speaking there is no regular system of drainage, only side ditches. Cesspools are common and receive the drainage of houses, or it flows into back yards, and so into the subsoil in either case.

Reference is made in the present report to the use of V-shaped drains for street drainage. In our "Suggestions" we have proposed the introduction of shallow-sectioned impervious surface drains to convey away all surface water or other liquids quickly to an outlet, and to keep them from filtering into the subsoil. V-shaped drains are generally made of stone with the edges laid together, but unless the joinings be made water-tight the fluid sewage may still filter into the subsoil. In using drains of this construction therefore, it is necessary to bed all the edges and joinings in cement, so as to render the drain practically impervious.

Conservancy, which means sweeping streets and removing the sweepings, was provided for in no more than 639 towns and villages out of 47,242 of these population groups.

"The towns and villages in which no such establishments exist are left to take care of themselves." And as the people have no idea of the relation between filth and sickness, the two of course go together. Mr. Price, Collector of Chingleput and President of the Local Board, has taken a warm interest in village improvements, and he again reverts to the subject in the present report. He again urges the provision of a minor municipal law giving the powers required for small local improvements, which had been previously objected to as involving increased taxation. But we have long since called attention to the general principles involved in the question, for in these small population groups there is very little which might not be done by the people themselves, and as the filth causes in every village house endanger not only the inmates but all the neighbours, the public principle is clear enough, namely, that no one has a right to use his property in such a way as to endanger the health or convenience of his neighbours, and as a result every householder should be called on to keep his surroundings in a wholesome state, or to pay someone for doing it. There are besides village officers and subordinates directly charged with seeing to the performance of these necessary duties, and what is really required, as it appears to us, is to reorganize this staff and set it to work.

There is no escape from the conclusion that unless this be done and a modicum of funds provided where required, the people will deteriorate in health and condition, and lives as well as property will be quite unnecessarily destroyed when epidemic seasons come round.

24. *Jails*.—The average strength of prisoners in 1881 was 10,322, admissions to hospital were 7,664, and 428 died.

The following abstract of admissions and deaths since 1874 through the period of famine and scarcity, 1877–78, will show the present state of prison health:—

Years.						Ratio per 1,000 admissions.	Ratio per 1,000 deaths.
1874	-	-	-	-	-	714.1	26.6
1875	-	-	-	-	-	752.6	88.7
1876	-	-	-	-	-	703.6	42.4
1877	-	-	-	-	-	971.3	175.4
1878	-	-	-	-	-	944.4	125.4
1879	-	-	-	-	-	890.5	55.8
1880	-	-	-	-	-	854.0	44.7
1881	-	-	-	-	-	742.5	41.4

It is satisfactory to see that the prison death-rate shows a tendency to return to its former position, and that as the condition of the people is improving the health of prisoners is also better.

Since 1878 there has been a great reduction in mortality from epidemics. In 1881 the deaths from cholera were 3.2 per 1,000, from dysentery 8.9, and from diarrhoea 6.8 per 1,000. Dropsies and anæmia together caused a death-rate of 3.3 per 1,000.

The chief disease feature of the year was the great prevalence of fevers of intermittent type. Out of 2,645 fever admissions 2,379 were of this class. There were 90 cases of cholera, of which 33 proved fatal, and they all with two exceptions took place in the central and district jails, Trichinopoly. The central jail had no fewer than 84 cases and 33 deaths. The town of Trichinopoly itself, with a population of 75,306, yielded no fewer than 678 cholera deaths, or 9 per 1,000 of the population. With such a condition of the epidemic there can be no doubt that persons living under the usual restrictions of prison life would be in danger, and we have two "theories" of the origin of cholera in the prison, one leading to no practical action, the other leading to proper precautions.

"Theory No. 1" is as follows:—"The medical officer in charge thus reports. Cholera was prevalent in the town 20 days previous to its outbreak in the central jail, and it was probably communicated by contractor's servants, warders, and policemen coming into the jail from the town."

Not an atom of evidence is adduced to sustain this view, and of course its logical result would be to shut up the prison and to let the inmates get on as best they could without supplies. But the worst feature of the case is, that this view ignored altogether what appears to have been the real cause of the outbreak. This is given as follows:—

"Theory No. 2." The Inspector General of Jails, Colonel Tennant, writes:—"Whilst at Trichinopoly, I visited the municipal filth dépôt. It was evident that the filth had been thrown on the ground and left seething in the sun, and not covered up in pits; the smell was something frightful, and the filth lay exposed, although endeavours had recently been made to cover it over with earth. When cholera was prevalent in the town, it is but reasonable to infer that choleraic discharges were carted away with the filth and thrown on the ground at the dépôt. The wind blew from the direction of the filth dépôt towards the market place, and I understand that cholera was very bad in that part of the town. Mr. Johnston informs me that about the middle of November the wind changed and blew directly over the dépôt to the central jail. The distance from the filth dépôt to the central jail, I should say, is little more than a mile." Cholera appeared in Trichinopoly on 19th October, and 20 days after this would bring us to the change of wind and the outbreak of cholera in the jail. The case belongs to a well-known class which includes other diseases besides cholera, and not requiring cholera discharges to produce such results, and while we must agree with the Sanitary Commissioner that removal of the dépôt is a necessary improvement, because such a measure would rest on actual fact, he has adduced no practical reason except the unproved opinion of the medical officer given above as "Theory No. 1," for quarantine procedure.

The subject is one of so much importance for the protection of human life that any alternative which could afford the slightest pretext to the municipality for not dealing with the filth dépôt may in itself become a death cause.

25. *General Remarks and Personal Proceedings*.—Under this head the Sanitary Commissioner gives a brief summary of his own inspection work, in regard to which it will be sufficient to say that the disease causes he met with in villages may be classed, as in former years, under the heads of bad water polluted by filthy habits of the people and filth inside and outside houses, but he is disposed to think not unfavourably of native houses when compared with those of northern climates. He again reverts to the want of sufficient assistance for sanitary work, which, no doubt, is matter of necessity, but it is only one element in the reforms required for village populations in Madras Presidency.

26. In concluding these remarks on Dr. Furnell's Report for 1881, we consider—

(1.) That it affords evidence of sanitary progress, and on this subject we should have spoken more positively if we had been sure of the accuracy of the statistics. Had they been reliable there would have been matter for congratulation.

(2.) That there is no proof that Tirupati festival had any influence on the course of a true cholera epidemic which covered Southern India, and as regards the statement of mere unsupported opinion as to the spread of cholera by intercourse, it ought never to be admitted into any public report. At the bedside of the sick a medical officer has often to depend on general impressions and probabilities in forming his opinion, but on great questions of epidemic movement involving public interests, impressions and improbabilities can have no place.

The most carefully observed facts can alone be admitted as evidence, and even on this ground local facts may lead to error, unless taken in connection with the general history of an epidemic.

This matter has been fully dealt with in a letter from the Government of India to the Government of Madras on the cholera of 1881, in which it is clearly pointed out that the duty of the Sanitary Commissioner is to reject all mere opinions, and to sift the alleged facts in their relation to the epidemic, and they very justly say that "there can be no doubt that the publication of such theories as are contained in this report is likely to prove most embarrassing, especially at the present time, when the International Sanitary Boards at Constantinople and Alexandria not only eagerly accept these theories, but immediately proceed to put them in practice, to the great disadvantage of India." It is very much to be regretted that, at the present day, there should be found persons to propagate these groundless opinions, and that there should be others who do not scruple to act on them. It would almost appear as if the best way to deal with the whole question would be to treat it simply as a judicial one, without reference to professional opinions of any kind. The alleged facts are either true or not true, and they should be treated as any other facts may be treated in a court of justice.

(3.) In regard to improvements in towns and villages, we have laid down the general principles on which these should be carried out in our "Suggestions for the sanitary improvement of Indian stations and their vicinity" (1882), and we are desirous simply of repeating what we have stated in former years, namely, that existing methods of dealing with villages, such as they are, should be better systematized, and the village officials called on to give practical effect to powers which they appear to have already. And we hope with the Government of Madras, that "in local fund circles the Government trust that the several boards will soon see their way to making larger sanitary grants than they do at present, especially for the improvement of village sites and of the water-supply. As it is," they say, "the allotments, the Government regret to notice, were not fully utilized. In no circle can it, in truth, be pretended that objects were wanting on which the money might be usefully expended. The Board of Revenue are requested to pay special attention to this matter."

We sincerely trust that the results of this enlightened view of the subject will show themselves in future reports.

25th June 1883.

No. 3.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for BOMBAY for 1881.

1. Mr. Lumsdaine's Report for 1881 contains a full discussion of the census results of the year from which we propose to abstract the data bearing on the sanitary state of the population. These are as follows :—

Including the military population, numbering 35,660, the census returns showed that there were in the 24 Presidency districts—

Males	-	-	-	-	8,497,718
Females	-	-	-	-	7,956,696
Total	-	-	-	-	<u>16,454,414</u>

The area occupied by this population is 123,860 square miles, and the average density was 132·85 per square mile. The lowest density, 15·98 per square mile, was in Thur and Párkár district and leaving out Bombay city, which had a density of 35,145·27 per square mile, the highest district density was in Kaira, which reached 500·18 per square mile.

The population per square mile in each province stood as follows :—

Northern Deccan	-	-	-	-	131·18
Southern Deccan	-	-	-	-	172·93
Konkan	-	-	-	-	256·17
Guzarat	-	-	-	-	281·33
Sind	-	-	-	-	50·55

The numbers of population for ages under 20 cannot be given.

Arranged according to classes there were enumerated—

Mahomedans	-	-	-	-	3,106,482
Hindus	-	-	-	-	13,128,729
Christians	-	-	-	-	138,326
Other classes	-	-	-	-	80,877
Total	-	-	-	-	<u>16,454,414</u>

2. At the previous census of 1872 the enumerated population of that year was 16,276,886, but since then, Bombay Presidency has been the seat of famine, and the following differences in population, shown by the census of 1881, are partly due to this calamity :—

Divisions.	Increase of Population.	Decrease of Population.
North Deccan - - -	65,917	—
South Deccan - - -	—	365,286
Konkan - - -	222,547	—
Gujarat - - -	43,704	—
Sind - - -	210,646	—
Total - - -	542,814	365,286

The chief losses of population were in the Deccans. In the North Deccan the apparent increase was only 1·57 per cent. in 10 years, while the South Deccan lost 9·59 per cent. of its population, but the way in which increases and decreases are distributed in the districts appear to show that part of the gain or loss in particular cases was due to movements in the population. The actual gain in 10 years, however, was only 177,528 on the population of 1872, or 1·89 per cent.

3. *Births.*—There were registered in 1881 births of—

Males - - -	-	239,912
Females - - -	-	219,745
Total - - -	-	459,657

This is the largest number of births yet registered in Bombay Presidency. The lowest number ever registered was in 1878, succeeding the famine, viz., 243,253 so that the population is rapidly recovering its normal rate of increase. There is one peculiarity in the birth registration which has never been fully accounted for, and this is the high excess of male over female births registered. For the last nine years 111·16 births of males have been registered in the Presidency for every 100 births of females. The largest increase of births in 1881, namely, 35·17 per 1,000 of the census population, took place in the Southern Deccan, which suffered most loss from the famine.

4. *Deaths.*—The deaths registered in 1881 were, of—

Males - - -	-	202,166
Females - - -	-	179,284
Total - - -	-	381,450

The death-rate on the census population of 1881 was 23·18 per 1,000, and for every 100 female deaths there were 112·76 male deaths registered, which may be contrasted with the births according to sex in the same year, namely, 100 females to 109·18 males born. Death-rates varied greatly in different districts. The lowest registered, 6·56 per 1,000, was in Upper Sind frontier, where the rates hitherto registered have been much below the average. The highest registered rate in 1881 was in Broach district, namely, 37·91 per 1,000. The rates, according to divisions, were as follows :—

	Deaths per 1,000.
Southern Deccan - - -	24·90
Northern Deccan - - -	22·28
Konkan - - -	22·14
Gujarat - - -	31·39
Sind - - -	13·22

The Sind death-rate is apparently under the truth, but in the other districts there has been much good registration work done.

Between 16 and 16½ per cent. of deaths took place in infants over the whole population, and 19·76 per cent. of total deaths were registered during the same ages.

5. *Causes of deaths.*—The following death causes were registered in 1881 :—

Diseases.	Total Registered Deaths.	Ratio per 1,000 of Popu- lation, 1881.
Cholera - - -	16,694	1·01
Small-pox - - -	539	0·03
Fevers - - -	272,403	16·56
Bowel complaints - - -	30,342	1·84
Injuries - - -	5,950	0·36
All other causes - - -	55,522	3·38
All causes - - -	381,450	23·18

We shall discuss the leading facts of the year's disease history under each of these heads.

6. *Cholera*.—Cholera deaths, which were only 684 in number in 1880, rose to 16,694 in the following year. In the first quarter of 1880 there were 543 cholera deaths. In the second quarter there were only 24 deaths. In the third quarter there were 20 deaths, and we may connect the epidemic of 1880 with that of 1881 as follows. There were three deaths from cholera in October, two in November. There was then a sudden leap up to 92 deaths in December, and this was really the commencement of the epidemic which prevailed in 1881 in the following monthly proportions :—

Months.	Cholera Deaths, 1881.	Months.	Cholera Deaths, 1881.
January - - -	79	July - - -	2,618
February - - -	47	August - - -	6,568
March - - -	23	September - - -	3,327
April - - -	20	October - - -	1,408
May - - -	344	November - - -	500
June - - -	1,499	December - - -	266

Cholera in 1881 was not universally prevalent in the province. Sind division registered no cholera deaths. But the disease showed its presence in all the districts of the other Presidency divisions, with the single exception of Panch Mahals, in Gujerat, which escaped. Leaving out Sind division, there are in the other divisions 225 registration circles, of which 144 returned cholera deaths. In the divisions where cholera was present there are 21,026 villages, and all the cholera deaths were reported from 1,534 of these. There are 62 towns with an aggregate population of 2,102,645, 29 of which yielded 2,720 cholera deaths. The remaining deaths, 13,974 in number, were registered in country circles. The deaths registered in December 1881 would lead us to expect that this epidemic would pass over to the following year.

There are no data in the present report except those under the denomination of "conventional seasons" to show what was the relation between cholera prevalence and meteorology, and these it is unnecessary to reproduce.

Monthly climatic elements from localities where they might be usefully compared with monthly deaths from cholera appear to be at present unattainable, but this ought not to be so under a regularly organized meteorological department.

7. As an interesting contribution to local cholera history, we shall introduce the following abstract of a table given by the Sanitary Commissioner to show the relation of cholera mortality to attacked villages :—

Months.	Cholera Deaths.	Attacked Villages.	Months.	Cholera Deaths.	Attacked Villages.
January - - -	79	7	July - - -	2,618	212
February - - -	47	2	August - - -	6,568	629
March - - -	23	3	September - - -	3,327	359
April - - -	20	4	October - - -	1,408	146
May - - -	344	24	November - - -	500	49
June - - -	1,499	80	December - - -	266	19

These figures reproduce the experience obtained in other districts of India, namely, that the relative monthly mortality includes two factors, the number of attacked villages and the proportionate intensity of cholera at the time.

The next abstract gives the registered cholera mortality for Bombay Presidency during a period of 16 years to show the epidemic law of cholera :—

Years.	Total Cholera Deaths.	Years.	Total Cholera Deaths.
1866 - - -	23,027	1874 - - -	37
1867 - - -	5,143	1875 - - -	47,555
1868 - - -	6,347	1876 - - -	82,117
1869 - - -	52,330	1877 - - -	57,252
1870 - - -	2,666	1878 - - -	46,743
1871 - - -	5,821	1879 - - -	6,937
1872 - - -	15,642	1880 - - -	684
1873 - - -	283	1881 - - -	16,694

These data show a triennial period of increase. The three years 1876–77–78 were those of the period of scarcity, which was accompanied by an extraordinary outburst of cholera in other districts of India, as well as in Bombay. There is another table showing the law of cholera prevalence in Bombay city which it is worth while to give, because in this case the Sanitary Officer has made a decided inroad on the march of the law. In this case the data are for 33 years, up to 1880, and 34 years with 1881 :—

Years.	Total Cholera Deaths.	Years.	Total Cholera Deaths.
1848 - - -	69	1865 - - -	2,887
1849 - - -	2,128	1866 - - -	332
1850 - - -	2,997	1867 - - -	111
1851 - - -	5,485	1868 - - -	227
1852 - - -	1,520	1869 - - -	754
1853 - - -	1,148	1870 - - -	386
1854 - - -	3,507	1871 - - -	263
1855 - - -	1,645	1872 - - -	190
1856 - - -	1,846	1873 - - -	92
1857 - - -	2,181	1874 - - -	19
1858 - - -	115	1875 - - -	884
1859 - - -	1,985	1876 - - -	374
1860 - - -	1,961	1877 - - -	2,510
1861 - - -	641	1878 - - -	1,165
1862 - - -	3,170	1879 - - -	323
1863 - - -	2,209	1880 - - -	30
1864 - - -	4,847		

The cholera deaths in Bombay city in 1881 amounted to 529, while the 33 years' mean showed 1,453 cholera deaths. Since 1865 Bombay has received a water supply after the English model. It then was put under a sanitary police, which has kept up a warfare against filth; drainage was subsequently commenced, and is now being carried out. The epidemic has been dealt with in the following manner, as given by the Sanitary Commissioner for the year 1881, but it shows the measures usually followed when cholera breaks out:—"In every place in the native town where cholera broke out the most prompt and stringent measures were taken. During one quarter no fewer than 500 persons were removed from buildings where cholera showed itself. Prompt measures were adopted wherever there was a presumption that a building, or a drainage, was defective. In other cases the tiles were taken off affected buildings, and holes made in the walls so as to let in light and air; earthen floors were dug up and sprinkled with carbolic acid, and the walls washed with carbolic acid and lime, disinfectants were freely used in the houses and in the vicinity, improvements were effected wherever the disease was discovered, air spaces were formed, floors were raised, and free ventilation secured. Sulphur fires and sulphur fumigations were largely resorted to." During an epidemic the responsibility of all measures rests with the local sanitary authority, and it would be out of place to separate between the necessary and unnecessary in this enumeration. The public had confidence in what was done, and we can only deal with the probable results, which, in the present case have been sufficiently remarkable in the course of years of experience.

The years 1877 and 1878 in the above table were the famine and scarcity years, when the city became crowded by starving thousands from the adjacent districts, and they rather show what sanitary measures could accomplish under these exceptionally unfavourable conditions than what these measures had really done for the city. We shall, however, include them, and divide the whole series of years, 34 in number, into two groups of 17 years each, because during the last 17 years sanitary work has more or less been done. The following are the results of this comparison:—

Years.	Cholera Deaths.
1848 to 1864 - - -	37,454
1864 to 1881 - - -	11,026

There is plenty of sanitary work to be done in this great city of 773,196 inhabitants; but these facts, extending over a long series of years, appear to show that what has already been done has by no means been labour in vain. The figures do not even show the whole gain to public health, because while the registration has been improving with advance of sanitary work, and so exhibiting a more accurate enumeration of cholera deaths than could be attained in the first 17 years of the period, the population of the city has been rapidly increasing of late years, leading to an increase of crowding, and the cholera death-rates to population in the earlier years were hence much greater than the actual cholera deaths would show at first sight.

9. The present report contains a statement of cholera attacks, of which there were 34,883 reported in the Presidency. The deaths, as already stated, were 16,694 for the whole Presidency, or 47·36 per cent. of the attacks, and the cholera deaths amounted to 4·38 per cent. of the total year's deaths; a small matter when compared with the mortality from fevers, which amounted nearly to 72 per cent. of the total deaths of the year.

10. There is not much information given in the report as to the local causes connected with cholera prevalence, but what is given is in entire accordance with past experience, viz., that filth and bad water are the usual localizing causes. One outbreak in Ahmedabad Jail may be briefly noticed, on account of certain facts connected with it. There were 117 deaths from cholera in Ahmedabad city. The weather during the jail outbreak was very wet, close, and hot. All the sewage used to be buried in the jail garden, but after cholera appeared the sewage was removed by the municipality. Cholera stools were buried in the vicinity of the jail. All clothing, bedding, &c. of cholera patients was burnt. Nothing is said about the water-supply. It is further stated that "All persons who were attacked had been a considerable time in jail, and had no apparent communication from outside. . . . While cases occurred in all parts of the jail on the ground floor, there was only one attacked in the cells on the upper story."

We mention this experience as the first of the kind which has been obtained from India, and, as a result of it, female prisoners were sent to the upper floors, which they were not allowed to leave.

The first cholera case in the jail was admitted on 16th July, the last on 20th July. There were 11 cases, of which five proved fatal. The outbreak was a local one, and no suspicion of spreading by intercourse appears to have arisen.

11. As a supposed case on the other side, of spread of cholera by contagion, we may mention the epidemic cholera in Surat, the first case of which was reported on the 23rd January, but the first case of what was considered to be the real outbreak took place "on 14th May, in the lines of the 10th " Regiment Native Infantry, and from this starting point the disease eventually spread in all " directions." Surat district had a population in 1881 of 491,125, and Surat town of 109,844. In the rural circles of the district there were 1,841 deaths from cholera, a mortality of 3.75 per 1,000, while the town yielded 910 cholera deaths, a ratio of 8.28 per 1,000. These 2,751 cholera deaths took place in 8 registration circles out of 10, and in 149 population groups out of 778, and the whole district had a cholera death-rate of 4.48 per 1,000, by far the highest district-rate of the year, and threefold the previous five years' cholera death-rate. The town-rate, 8.25 per 1,000, was very high, and the sanitary questions raised by the facts, as a whole, are as follow.

Seeing that cholera existed in considerable intensity in the country, to what removable causes was the excessive town-rate due? The more obvious surface causes appear to have been connected with Mahomedan and Hindoo feasts, which were held in filthy compounds and on ground of the foulest description. To remedy this state of matters, "additional scavengers were engaged, and strict " attention was paid to the removal of refuse. Public latrines and private privies were well looked " after."

But mere surface temporary work such as this could not, by any means, have reached the real disease causes. This is clearly shown by the Sanitary Commissioner, who, in giving the details of his own inspection, says,—“It has been my lot to visit many places where the insanitary conditions “ were well nigh incredible, but never yet did I see such a whited sepulchre as Surat.” The town contains 27,143 houses, the soil is open, there is no drainage, and the water-supply is brackish. Most houses have a cesspit for sewage, and another for faecal matter, into which all the sewage and filth is passed, they are from 20 to 35 feet deep. In the town area, there are 16,000 sewage pits and 10,015 cesspools. “Every one of these is in direct communication with an inhabited house. . . . “Upwards of 100,000 persons live on an area honeycombed with 25,000 of these foul pits, and they “ get their drinking water from wells sunk in the interspaces.” During the rains, the sewage pits have to be closed and all refuse water is run into the streets. At the time of the inspection, “the “ surface was literally swamped with stagnant pools of the foulest sewage.” In order that there may be no mistake in this matter, the Sanitary Commissioner has given plans and sections, showing the deadly nature of these household arrangements, which (it may be stated) resemble closely those described by Captain Galton in his account of Memphis, U.S., in Vol. XIII. of the India Office Sanitary Reports, in which city they had decimated the population with epidemics, and almost destroyed the resources of the municipality. Again and again have attempts been made, by persuasion and compulsory rule, to improve the condition of Surat, but the one remedy not hitherto tried is simply that of affording the required facilities for water-supply and drainage, without which neither law nor philanthropic teaching can by any possibility be of use. Captain Galton's paper shows how a similar case has been successfully dealt with elsewhere.

Such being the facts of this cholera epidemic in Surat town, we are not surprised that the Government of India should have called the attention of the Government of Bombay to the extraordinary statement that, although the most searching investigation failed to find a cause for its origin, “the “ extension was clearly due to human intercourse.” Surely this is an example of opinion and facts starting from the same point and marching in quite opposite directions. We concur with the Government of India in deprecating the introduction of remarks of this character into official documents unless they are established by sufficient evidence, of which moreover there is no trace in this report.

12. *Small-pox.*—As already stated, deaths from this disease numbered 539 in 1881, or 0.03 per 1,000 of the population, by far the lowest number of small-pox deaths hitherto registered in Bombay Presidency. In North and South Deccan and in Gujerat the total small-pox deaths numbered only 26, and in the Konkan division there were 122 deaths, and all the others, 391 in number, took place in Sind, in which division there was not a single death from cholera.

In the two affected divisions the monthly incidence of small-pox mortality was about the same, and the following abstract will show what it was for the whole Presidency :—

Months.				Small-pox Deaths.	Months.				Small-pox Deaths.
January	-	-	-	26	July	-	-	-	37
February	-	-	-	65	August	-	-	-	28
March	-	-	-	79	September	-	-	-	13
April	-	-	-	89	October	-	-	-	12
May	-	-	-	81	November	-	-	-	5
June	-	-	-	86	December	-	-	-	18

In the North and South Deccan there are 9,797 villages, only eight of which yielded small-pox deaths, and these villages are situated in four out of 131 registration circles, showing how very sparsely the disease was distributed. In the Konkan 16 circles out of 46 registered deaths from 30

villages out of 5,454. In Gujerat all the deaths took place in five villages out of 3,275. In Sind where the disease attained something of an epidemic character, deaths were registered in 36 circles out of 60, and in 154 villages out of 3,405.

These facts have an important bearing on the history of small-pox in Bombay in relation to the practice of vaccination, as may be seen by the following abstract, which places small-pox deaths alongside successful vaccinations and re-vaccinations since 1872 :—

Years.	Deaths from Small-pox.	Successful Vaccinations and Re-vaccinations.
1872 - - - - -	26,699	—
1873 - - - - -	9,935	527,088
1874 - - - - -	3,908	588,169
1875 - - - - -	3,461	681,600
1876 - - - - -	11,817	755,024
1877 - - - - -	27,869	764,918
1878 - - - - -	4,475	691,437
1879 - - - - -	1,156	581,051
1880 - - - - -	940	603,375
1881 - - - - -	539	661,904

The three years 1876-77-78 include the famine period when there was a great small-pox epidemic in other regions of India as well as in Bombay Presidency. If we leave these years aside and compare the first three with the last three years of the series, it would seem that vaccination has been influencing small-pox mortality. More experience would of course be required to establish such a conclusion, but there can in the meantime be no doubt in regard to two facts shown in the table, namely that a large amount of really good work is being done by the efficient vaccination service of Bombay, and that there has been a great reduction in small-pox mortality.

13. If we leave out the three years of famine and scarcity during which the birth-rate fell below the average, we find that for the years 1879-80-81 there were 1,118,400 births registered, while the vaccinations and re-vaccinations were 1,846,320 in number, but these latter include adults as well as children. Two official yearly results for 1880-81-2 added together will show better what the vaccination work amounted to :—

	Two Years.
Births - - - - -	830,530
Children available for vaccination - - - - -	700,066
Children vaccinated { under 1 year - - - - -	530,429
{ 1 year to 6 - - - - -	284,473

This abstract shows that the vaccinations under one year exceeded five sevenths of the total number of children available, and amounted to five eighths of the total births. The year 1881 was a year of low small-pox mortality. There were 459,657 children born. Of children under one year of age 282,480 were successfully vaccinated. The deaths under one year were 75,371, and of these deaths only 132 were from small-pox.

In discussions of data of this class we must always make allowance for the erratic nature of epidemics but taken simply as facts the data are remarkable.

14. In the course of the year 434 heifers were inoculated in Bombay where only animal lymph is used, and all succeeded except 34. The total number of heifers inoculated was 473, of which 38 failed. The cost was 327*l*. In Poona, animal and human lymph are both used, but vaccination from arm to arm is universal except in these two cities. In the official year 1881-82, 96·52 per cent. of primary vaccinations in the Presidency, and 71·65 per cent. of re-vaccinations were successful. The ratios for Bombay city, where only animal lymph was used, were for primary vaccinations 93·36 per cent., and for re-vaccinations 96·52 per cent. Further experience, however, would be necessary to show the relative value of each method.

15. The following was the vaccination establishment for the year :—

Deputy Sanitary Commissioners - - - - -	5
Superintendents of vaccination - - - - -	3
Inspectors of Sanitation and Vaccination - - - - -	31
Assistant Superintendents, ditto - - - - -	5
Clerks and karkuns - - - - -	28
Vaccinators - - - - -	432
Peons - - - - -	481
Total - - - - -	985

The total expenditure for the official year 1881-82 was 26,035*l*. The cost of each successful case was 5*s*. 10*p*.

The vaccination inspectorial work of the year included 5,289 encampments, 9,218 travelling days, during which 88,941½ miles were gone over and 14,762 villages were visited, and 343,652 children were inspected.

Details regarding the vaccination service are very complete, but there is no account of any sanitary inspecting or advising work having been done by the vaccination officers. We would strongly recommend that every Sanitary Report from Bombay should in future include all sanitary work of this kind, which has been done; otherwise we shall have to conclude that one of the main duties of this large establishment has still to be undertaken.

15. *Fevers*.—As we have already seen, the small-pox deaths in Bombay Presidency were 539, while the deaths from fevers, mainly due to unhealthy locality, were 272, 403. For every death from small-pox there were above 500 from fevers, which, besides cutting off so many in the prime of life, destroy the working power of those who survive. It is not out of place, therefore, in admitting the importance of vaccination work to ask whether it does not savour of large effort and expenditure mainly in a wrong direction, so long as local fever-causes are not grappled with. The following abstract of fever mortality will show how little impression, if any, has been made on its local causes :—

Years.	Fever Deaths.	Years.	Fever Deaths.
1872 - - -	206,747	1877 - - -	236,865
1873 - - -	188,201	1878 - - -	357,376
1874 - - -	187,717	1879 - - -	286,526
1875 - - -	219,156	1880 - - -	246,779
1876 - - -	220,833	1881 - - -	272,403

Even allowing for the higher mortality of the famine and scarcity years 1876–7–8, the rates of subsequent years show how comparatively unimportant to the public interests is the small-pox death-rate when contrasted with the fever-rate, for the reduction of which so little has apparently been done.

16. In 1881 fever deaths were registered in all the 285 registration circles, with a solitary exception in Kaladgi district, and from 23,863 villages, out of a total of 24,431, showing the universal prevalence of the disease. The following were the monthly deaths registered in 1881 :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - - -	24,742	July - - -	20,458
February - - -	21,987	August - - -	25,000
March - - -	21,334	September - - -	24,784
April - - -	21,322	October - - -	24,726
May - - -	18,882	November - - -	26,069
June - - -	17,774	December - - -	26,273

Of the year's fever-deaths 241,547, took place among a country population of 14,351,769, equal to a death-rate of 16·83 per 1,000. In the towns, 62 in number, with an aggregate population of 2,102,645, there were 30,856 fever deaths = a death-rate of 14·67 per 1,000. The fever death-rate for the whole Presidency was 16·56 per 1,000, against a previous five years' rate, which included the famine period, of 17·76 per 1,000. The highest district fever death-rate of the year was 33·14 per 1,000 in Broach, the lowest, 5·37 per 1,000, was registered in Upper Sind frontier district. The Belgaum cantonment had the lowest fever death-rate of the year, namely 5·53 per 1,000, and the highest town rate was 52·76 per 1,000 from Viramgan town in Ahmedabad district.

17. The usual difficulty presents itself in dealing with fever mortality on account of the vagueness of the nomenclature. One of the Deputy Sanitary Commissioners considers that the actual fever mortality is no more than a fifth part of the registered death-rate from this cause. We have often called attention to probable errors in classifying deaths preceded by febrile symptoms, but there are plenty of facts to show that this opinion greatly understates the actual fever mortality. We have suggested on other papers that possibly the best test to adopt when deaths from fever are reported would be to ascertain whether there had been completed paroxysms. The heat test by itself is scarcely sufficient.

18. The only statement on the subject of fever causes is the following, quoted from a report of the same Deputy Sanitary Commissioner, in regard to North Deccan fevers. He says :—
 “ I consider all these diseases, viz., cholera, fever, and bowel affections, are propagated by contaminated water, and if the death-rate is to be diminished it can only be done by giving each village a good supply of clean water, and I hold that a public well under proper supervision in every village is a necessity more frequently calling for support, and is of more primary importance, than education or hospitals, or any of the hundred and one demands made upon and granted out of village funds, whether local or municipal.”

There is no doubt of the importance of this recommendation, which is, indeed, one we have long ago made, a good village well or wells, dug in clean ground and away from all sources of surface impurity, with the immediate subsoil water cut off in the way shown in our revised “ Suggestions,” having the tube of the well raised above the ground level, and the surface carefully formed to drain

water away from the tube. These simple precautions, and an iron windlass, bucket, and chain for drawing, and a cover for the well above, would ensure a pure water-supply for every one, and would apparently present no caste difficulty in their operation. But there is plenty of experience to show that, while admitting the great danger to health of water containing putrescing animal matter, the purest water, even distilled water, would afford no protection against either fever, cholera, or bowel complaints, if other well-known causes of these diseases were left untouched. The duty of the Sanitary Officer is by no means confined to discussing points of what may be called water-etiology. The questions to be dealt with are by no means so simple. Health and disease, so far as their outward conditions are concerned, are the result not of one condition, however important it may appear, but of many, and there is no short road to knowledge in such matters. Water unfit for human use on account of animal impurities is something else besides a disease cause. It is a sign of filth and want of cleanliness about the water source or in the subsoil which supplies it, and no amount of well digging will be a permanent advantage unless village cleansing and surface draining go along with it.

19. The known causes of fatal malarial fevers in India may be here adduced as showing their probable nature in Bombay Presidency until we obtain more definite information on the subject. They are local filth and local damp, or wetness of subsoils under and around village sites and houses; cesspits; bad water, consequent on filth; damp houses and subsoils, consequent on want of surface drainage or from subsoil infiltration from rivers, from irrigation, where too much water is used, or from tanks or water springs on higher levels; overgrowth of jungle; keeping cattle in houses or compounds; sources of malaria in nullahs, wet land in which water stagnates, and the like. The more immediately important causes are those arising from want of cleanliness, with which the people might deal at once. The exact importance of each of these disease causes in any given case forms the problem with which the Sanitary Inspector has to concern himself, because on his decision depends not only improvement of health, but direction of expenditure.

In all such inquiries personal causes, such as deficiency of food and of clothing, have to be taken into account, but we have Indian experience on record to show that deaths from malarial fever take place in families where such personal causes are absent. Possibly, as the Sanitary Commissioner suggests, some of the malarial fever mortality may be due to typhoid fever. This is no doubt probable, but it would not account for the enormous fever death-rate.

20. *Bowel complaints.*—Deaths classed under this head numbered 30,342, yielding a death-rate of 1.84 per 1,000, against a previous five years' average rate of 2.28 per 1,000. The registration of this death cause presents the usual anomalies of general distribution of deaths which were local in their incidence. Bowel complaint deaths were returned from 267 registration circles out of 285, but out of 24,431 villages all the deaths were returned from 5,797.

Arranged according to months, the registered mortality in 1881 stood as follows:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	2,233	July - - -	2,626
February - - -	1,884	August - - -	3,735
March - - -	1,984	September - - -	3,375
April - - -	2,117	October - - -	3,082
May - - -	2,187	November - - -	2,567
June - - -	2,047	December - - -	2,505

Of these deaths the towns yielded 4,581, equal to a death-rate of 2.18 per 1,000. The country districts registered 25,761 bowel complaint deaths, or 1.80 per 1,000. The preceding abstract shows that the deaths rose during the rains. No account is given of the local causes.

21. *Injuries.*—The following abstract classifies the death causes under this head in 1881:—

Causes.	Deaths.
Drowning - - -	2,636
Poisoning - - -	113
Hanging - - -	217
Wounding - - -	382
Wild beasts - - -	120
Snake-bites - - -	1,209
Other causes - - -	1,273
Total - - -	5,950

Of these deaths, 3,424 took place in males, and 2,526 in females

Of the drownings, 320 were suicides in wells, and 32 in tanks. There were also 956 accidental drownings in wells, and 345 in tanks, so that 1,653 persons were drowned in water-supply sources in the course of the year.

Deaths from snake-bite exceeded by 30 those of the preceding year, and the following abstract shows the monthly prevalence of this death cause:—

Deaths from Snake-bite.

	Months.	Deaths in 1881.	Mean of 5 Years.
January	- - - -	39	30
February	- - - -	34	24
March	- - - -	55	45
April	- - - -	55	49
May	- - - -	95	93
June	- - - -	162	135
July	- - - -	191	164
August	- - - -	165	159
September	- - - -	161	160
October	- - - -	128	144
November	- - - -	80	68
December	- - - -	44	39

According to this table deaths from snake-bite have been increasing, and it apparently shows us at what period of the year war against snakes ought to be most vigorously followed up.

22. *Other causes.*—In the course of the year 55,522 deaths were registered, or 3·38 per 1,000 of the population, of which no classification was made.

23. *Sanitary works (Military).*—The actual outlay under this head in 1881 was 42,210*l.*, by no means a large sum, and of the amount 24,310*l.* was spent on the new water supply of Nasirabad. Most of the work paid for during the year appears to have come under the head of current repairs or small local improvements not bearing very directly on the sanitary state of barracks. Still works useful in their way have been done, and amongst these the following may be enumerated.

Water-supply of Nasirabad, referred to from the Danta reservoir, nearly completed and laid on to European Infantry, Royal Artillery, Native Infantry, and Native Cavalry lines by hydrants and standposts. We shall notice this work further on.

Improving drainage of Ghorpuri lines, Poona, and at Kirkee. Planting trees for protection at Poona, Kirkee, Colaba, &c.

Improving the ventilation in Ghorpuri barracks by wire gauge doors to break the inflowing currents.

Improvements in surface drainage at a number of stations, but it is not satisfactory to find Rs. 12 expended in making a cesspit for refuse water Mhow. All such water should be drained away.

New accommodation was provided or commenced in the course of the year, chiefly in Aden. Latrines were improved, and also well water supply at some stations.

There appears to be nothing more under this head which requires notice.

24. *Sanitary works (Civil).*—This section of the present report gives a very brief abstract of sanitary work carried out during 1881 in 162 municipalities, and somewhere about 75 local fund circles.

The Sanitary Commissioner describes the reports as being “exceedingly valuable,” but too long for insertion.

The total income of the municipalities was 256,979*l.*, and the expenditure on conservancy was 63,371*l.* This, of course, is exclusive of the city of Bombay, which has its own sanitary administration.

There are some points in the abstracts of municipal reports which may be noticed.

25. *Ahmedabad city* contains a population of 124,767, and had an income for the year of 27,389*l.*, out of which 5,351*l.* was spent on conservancy.

Its water-supply is raised from the river by pumping engines to settling tanks, from which the water passes into filters, and thence into storage tanks. Most of the distribution mains are earthenware pipes, and water is drawn for use by means of iron stand pipes and reservoirs. The only drainage is effected by open side drains along the streets. There are no cesspits. Latrines, public and private, are in use, all of which are cleansed by the municipality. All sweepings are burnt, and the ashes are mixed with night-soil and sold for manure. There are 27 iron-screened urinals. Markets, burial grounds, and cremation grounds are also provided. Ahmedabad has been improved on certain well-defined principles, which ought to furnish public health data for use elsewhere, but as we shall see the apparent results are no other than such as are usually adopted as proof of bad sanitary condition, for the same report shows that the death-rate of the city in 1881 was no less than 55·57 per 1,000, and that even this very high rate was not exceptional, for the previous five years' average was 57·75 per 1,000, both of which rates should be compared with those of Bombay, allowance being made for the fact that Bombay has a population of 773,196, above sixfold that of Ahmedabad. The Bombay death-rate in 1881 was 27·87 per 1,000, and had fallen much below its previous five years' average, which was 38·12 per 1,000. The decennial death-rate of Calcutta had been 28·7 per 1,000, and the rate of 1881 was 1·3 per 1,000 higher, or 30 per 1,000, on a population of 433,219.

26. We have suggested this comparison, because it has an important bearing on the class of sanitary works required in populous Indian cities. Bombay and Calcutta are being improved on a different basis of works from the plans adopted in Ahmedabad, Cawnpore, and elsewhere, and in advising an inquiry into the causes of high death-rates in Ahmedabad, which we are of opinion is necessary from the facts, we would suggest that the influences of these different methods of draining should be included.

The most striking fact on the year's death-rate is that shown in the following contrasted rates of the three cities from fever, to which Cawnpore may be added :—

					Fever Deaths per 1,000.
Ahmedabad	-	-	-	-	35.65
Cawnpore	-	-	-	-	33.96
Bombay -	-	-	-	-	8.29
Calcutta	-	-	-	-	8.60

The practical points suggested by the facts are,—1st. What are the causes of the high death-rates in Ahmedabad? 2nd. As the present works have not lowered the rate to those of the much more populous capital cities, could any change in the procedure effect this object; and if not, why not? The suggested burning of the city sweepings in the report within the walls of Ahmedabad would scarcely help us to a solution.

27. The next populous town which may be noticed is Surat, of which we have already given some account. It has a population of 109,844. Its annual death-rate for five years had been 23.67 per 1,000, much below the truth, apparently. In 1881 the rate was 38.32 per 1,000, of which 21.99 per 1,000, not far short of the entire five years' rate, was due to fever. The city contains 8,296 cesspools, it has no drainage except for surface water. Its water-supply is from wells in foul subsoil, or from the brackish river.

The only approximately satisfactory statement about Surat is, that the authorities have "under consideration" a scheme for supplying the place with water and drainage.

There appear to be complaints of the difficulty of improving the sanitary condition of Surat by fining people. How could it be otherwise? Let the authorities first drain Surat, and fill up all its cesspools, bring in water, and fill up all its wells. Give the people facilities for being clean, and then fine them if necessary.

28. *Nasik*.—A carefully prepared account of the sanitary condition of Nasik, by Mr. Hewlett, enables us to form a fair estimate of the condition of many similar towns. According to the census of 1881, its population was 23,766. Its average death-rate has been 50.79 per 1,000 during the previous five years, and 46.62 per 1,000 in 1881. Of this latter rate, no less than 29.45 per 1,000 was due to fevers. The town is built on the summit and slope of ground falling towards the Godavari river, at a height in the higher parts of 1,943 feet above sea level, and 64 miles distant from the sea. The subsoil is disintegrated trap rock, which absorbs rain, and is a source of water for the river Nasardi.

It would occupy too much space to enter on the numerous sanitary details collected by Mr. Hewlett, including as these do, not only an account of different town areas, but the municipal sanitary arrangements and proposed remedies. It will be enough to state that the inquiry points clearly to the operation of insufficient drainage and want of pure water as disease causes to be dealt with by engineering works. There are drains of a kind, but it is doubtful whether they are of use. Deposit accumulates in them, and Mr. Hewlett says they are not properly cleansed. There are 245 cesspools in the town, together with 1,400 private privies and 25 public latrines, for the cleansing of which there is a considerable staff entertained, and the night-soil is converted into poudrette, but Mr. Hewlett says that the principal part of the urine is not removed, but escapes into the drains, where it decomposes or finds its way into the river. The poudrette process consists in burning the town sweepings and mixing the ashes with night-soil, and allowing some drying to take place, it is then sold at four annas per cartload.

There are 825 wells in the town, but the chief source of drinking water is the Godavari. From the topography and subsoil of the town, it appears that both well and river waters contain evidence of sewage impurities. This brief statement of facts appears to bear out Mr. Hewlett's conclusion; he says, "the tables of mortality prove that a persistently high death-rate always obtains in Nasik, and its cause is, in my opinion, chiefly due to impure water and to an atmosphere vitiated by the dangerous emanations from the drains."

Nasik is a very old city, and it is not unlikely that part of its persistent high death-rates, especially from diseases of the epidemic class, may be due to the condition of the subsoil. On a ten years' average, cholera mortality has been 2.76 per 1,000 per annum, small-pox 1.34 per 1,000, fevers 21.04 per 1,000, and bowel complaints 2.31 per 1,000. The municipality appears to do what it can to improve the public health by temporary measures and with limited means, for its revenue is little more than 4,000*l.* a year. The amount allotted to public health in 1881 was only 1,814*l.*, and the present death-rates appear to continue after many years' trial of these methods of improving public health. All we can do is to point out the steps which Mr. Hewlett's facts appear to render necessary:—

1. With properly laid down street and road surfaces, all rainfall might be passed to the river.
2. The present unwholesome drains might be replaced by pipe drains to drain the houses.
3. Drains of this class would have to be connected with a town water supply, which is urgently required.
4. And, instead of passing sewage into the river, it might be applied for agricultural purposes.

In the meantime, it is worthy of consideration whether the present underground drains might not be advantageously dispensed with, and shallow surface drains, simply for the removal of rainfall substituted for them. Water must be obtained anyhow, and, when brought into the town, it must be removed after use or the fever-rate may be raised. Apparently a combined system of works would be more advantageous in the end.

29. *Ahmednagar* is another unhealthy city. Its population is 32,798, its five years' death-rate was 45·81 per 1,000, which in 1881 had risen to 54·91 per 1,000, of which 16·01 was due to fever, and 6·74 to cholera.

Water is obtained from three aqueducts, from the river, and from 39 public and 350 private wells. There appear to be two sets of drains. One underground, which conducts a small quantity of sewage for irrigating fields leased at 15*l.* a year; the rest of the drains consist of masonry conduits, cleaned out every year before the rains, and some are mere surface cuttings. Cleansing is done by the municipality, which sold the manure and street refuse for 219*l.* Ahmednagar has a water-supply, which no doubt, could be extended and improved, but as it is not at all unlikely that pouring in a constant volume of water into the city, without means for its removal, may be a disease cause, it is satisfactory to learn that a drainage scheme is under consideration. The municipality has clearly shown that cleansing may be made to pay, and there is every prospect that, if the water-supply were connected with a suitable drainage system, and the sewage applied to the land (as is done on a small scale at present), the sewage would, at all events, be safely disposed of, and possibly some portion of the outlay might be recouped. The death-rates clearly show that the whole case as regards the public health has not been met by present procedure.

30. *Poona*.—It is scarcely necessary to discuss the sanitary state of Poona. It has already a water-supply; and a system of drainage, combined with application of sewage to agriculture, is at present under consideration.

31. The examples we have given above will be sufficient to show the nature of sanitary engineering problems among the larger population groups, as brought out by the Sanitary Commissioner's inquiry. So far as we can see, all of them can be dealt with on the principles laid down in our revised "Suggestions." The application would, of course, have to be varied to suit local conditions, but the principles would remain the same.

A similar remark applies to the case of smaller municipal towns, of which many are briefly noticed under this section of the Sanitary Commissioner's Report. They have all certain features in common, such as damp, undrained sites, cesspits, wells dug in foul ground, or what may easily become so, doubtful water tanks, &c., but in the same suggestions we have given methods of dealing with such cases where funds for permanent works are not to be had at present. In many of them, the epidemic death-rates are high. The foundation of all progress in these small towns is cleansing and keeping clean. In many cases, as shown by the notes, considerable improvements of a simple kind appear to be currently effected, but their death statistics show that increased activity in sanitary work is needed.

32. In the *Local Fund Circles*, which include village sanitary work, the chief information given refers to improvements in wells and water sources, such as repairs, sinking new wells, and the like. There is little information as to the epidemic disease causes, and all that can be said is that so far as work is described as having been done it has been done in the right direction.

33. *General Remarks*.—Under this head are placed a number of separate reports on water-supply, certain of which we have already referred to, but there are others which merit separate notice.

34. *Thana*.—This town has a population of 14,456, its five years' average death-rate was 23·85 per 1,000, and its rate for 1881 was 20·27 per 1,000, of which 15·63 was due to fever, and 0·55 per 1,000 to cholera. In July 1880, a water supply-scheme, prepared by Mr. Maclaren, C.E., was sanctioned, and water was supplied to the town in 1881. The source is an impounded reservoir, with a dam 1,005 feet long and 31½ feet high. The surface water area is 489,400 square feet, and the contents 27,000,000 gallons. There is an outlet tower and valves, and the discharge pipe, 10 inches in diameter, is carried in a trench cut in the solid rock below the dam, and filled in with concrete. The cast-iron pipe to the town is 7 inches in diameter and 10,365 feet in length, having a fall of 108 feet. At the town end is a meter-house, whence the water is passed into cast-iron pipes, and so to hydrants (of which there are 16) for use. The available supply is calculated at eight gallons per head per day, and the cost was 8,463*l.* Drainage is a necessary complement of this augmented water-supply. Thana has 61 cesspools of brick and lime, and 98 common pits. The streets are side-drained, but (as the drain pipe is really the other end of the water-pipe) it may be suggested whether so excellent a work as this water scheme should not be connected with a drainage system, and these cesspits abolished.

35. *Pandharpur*.—Water-supply is provided on similar principles to that of Thana. The town had a population in 1881 of 16,910, liable, however, to considerable increase during pilgrimages. The number actually provided for was 25,000 at 10 gallons per head per day. To effect this object a catchment area of 10 square miles was finally adopted after trial, and has been found sufficient. The subsoil is trap, and the surface is covered with light grass, or partly with cultivation and a few trees. The rainfall on this catchment area averages 26 inches, but the extremes lie between 6·84 and 36·60 inches. An actual experiment, made in September 1880, gave the following results:—Rainfall in three days (12th to 15th), 6·75 inches. Amount of rain falling on catchment area, 156,816,000 cubic feet, of which 46,742,542 cubic feet flowed into the tank = 0·297 of the fall. The tank is placed at the end of the catchment area next the town. It has an available cubic capacity (after deducting the "bottom") of 79,166,083 cubic feet, and an area at the level of "full supply" of 196 acres. Water is passed through screened openings to the distributing reservoir, where, after filtration by a temporary arrangement, it is led into the town about four miles off by a 10-inch main, subdivided into eight and six inch mains, and finally distributed by 38 stand-posts, with one, two, or

four push-taps, which are said to answer well. The works are still to undergo improvement. The filtered water, as analysed by the Government analyst, gave 11·2 grains total solids per gallon, of which 2·4 were chlorine combined, 0·02 parts per million free ammonia, and 0·15 per million of albuminoid ammonia. The process of filtration removes a considerable quantity of vegetable *debris* and low forms of animal and vegetable life. The water is not all that could be desired as regards purity; and it is proposed to remove a village in the catchment area, and to restrict the use of manure. It is of course one of the conditions of water-supply of this nature that perfect cleanliness of the ground and of all open conduits should be maintained. But another condition is, that water brought into a town should be again removed after use by drainage. As "there is hardly one single well in the town or suburbs of which the water could be said to be fit for drinking," it would seem that filling up these wells was a corollary of improved water-supply.

36. *Nasirabad water-supply*.—On account of numerous cases of enteric fever at this station, we advised that a special examination of it should be made by the Sanitary Commissioner. This has been done, but, unfortunately, most of the troops were absent. The Commissioner says that as he found the station "there were absolutely no insanitary conditions, and no apparent causes to which the past sickness could be assigned."

There is, however, an apparent exception to this view in the account given of the water supply, which is derived from a well at the village of Dilwarra, two miles away, and has been used both by the people and for supplying water for troops. This well borders on a public road, and is apparently below the level of the village. The people draw water from it in the usual way by ropes and vessels. The well is uncovered, and there is cultivation close up to it. The following is an analysis of the water:—Total solids, 28 grains per gallon, including 3·5 grains of combined chlorine; free ammonia, 0·02; and albuminoid ammonia, 0·14 parts per million. "Before my visit," says the Sanitary Commissioner, "it had been cleaned out, and several cartloads of black mud were removed. There was no available record of former cleanings."

There can be no manner of doubt that this statement indicates a grave danger to troops using such water; but we have no means of knowing to what extent it predisposed the men to enteric fever. The danger has been recognised, and water for the station is partly obtained from Danta lake, a proposed future source of supply. This is a newly constructed reservoir about six miles from Nasirabad, whence water is brought by gravitation to stand-pipes within the lines.

The analysis of the water is unfavourable to its purity. It is as follows:—Total solids, 15·4 grains per gallon; chlorine, 4·2 grains per gallon; free ammonia, 0·24 parts; and albuminoid ammonia, 0·32 parts per million. It contains a large quantity of vegetable *debris*, and of animalcular life. The analyst pronounces this water, as well as that from Dilwarra well, as being "bad," and he is quite right. Before, however, the Danta lake water is condemned, the gathering ground and its surroundings should be carefully examined. The whole area must be kept free of every source of impurity, and measures would have to be adopted continuously for this purpose. If the collecting ground is protected from sewage and refuse vegetable matter, filtration would do what is needed, but not filtration as it appears to have been conducted by barrack filters, for there is an instance given of a barrack filter having added above 11 grains per gallon to the impurities in Dilwarra well water, obviously from neglect of filter cleaning.

The Dilwarra well is quite unsuitable for the supply of troops, and if the Danta lake does not supply the want, then the only other resource would appear to be to dig a special well for the station in new clean ground, away from every source of pollution, and to adopt the supply arrangements we have described in our revised "Suggestions." All other wells within station limits should be closed. They cannot be depended on. One of them, in the artillery horse lines, yielded no less than 123·2 grains of chlorine per gallon, showing an extraordinary degree of subsoil pollution.

The bazaar at Nasirabad requires improvement in its sanitary condition, but the hazardous condition of the water-supply is the main insanitary condition established by this special inquiry.

57. *Sholapur water-supply*.—We quote the following account from the Report:—

"The town is now supplied by gravitation. The water is taken from the Ekrûk perennial canal, at the fourth mile, and is first passed into a settling tank. It is then led to a well in the engine house, from which it is pumped into two reservoirs at different levels. The supply is five gallons per head per diem for 50,666 persons. The distribution is by pipes and hydrants, the quality is good, and all the arrangements are everywhere excellent."

Here is the analysis of water drawn from a stand-pipe:—Total solids, 10·85 grains per gallon, of which chlorine combined 1·05 grains, free ammonia 0·005 parts, and albuminoid ammonia 0·07 parts per million. Now, by way of contrast, let us insert the analysis of a Sholapur town well:—Total solids, 45·8 grains per gallon, of which chlorine combined 11·2 grains, free ammonia 0·02 parts, and albuminoid ammonia 0·04 parts per million.

Can this great change in the character of the water-supply have had any part in the following statistical results to the public health? Five years' average death-rate preceding 1881 = 71·77 per 1,000. Death-rate 1881 = 29·36. But of this rate 20·14 per 1,000 was due to fever. We may ask the question, What means have been adopted for completing the new water-supply by removing the large quantity of water brought into the town after it has been used?

38. *Hyderabad water-supply* is derived from the River Indus, and, after passing through settling tanks, it is conducted for two miles in a conduit, and then to a service reservoir within the fort, whence it is distributed to the town. The (daily?) consumption in the hot season is 169,800 gallons for the town, and 74,900 for the cantonment, and about a third less during the cold season. The

population of Hyderabad town is 45,195. Its death-rate in 1881 was 24·41 per 1,000, against a previous five years' average of 40·42 per 1,000.

39. *Karachi water-supply*.—After 20 years' delay, the projected works for this object are approaching completion. Water is obtained in unlimited quantity from a porous water-bearing bed close to the Mulleer river, at a distance of 18 miles east of Karachi, by conduit to the town. There are two wells, within each of which is a cast-iron valve shaft, with three 24-inch regulating valves worked from the ground level. From the main delivery valve a 24-inch cast-iron pipe will be laid for a mile and a quarter, opening into a masonry conduit built of rubble, and lined with Portland cement. Its sectional area is 5 feet 6 inches, with a minimum fall of 3 feet 9 inches to the mile, and its length is 16 miles. At the Karachi end of the conduit the water is received into an inlet well 20 feet in diameter, alongside the distribution reservoir, which in its turn is capable of holding two millions of gallons, and means are provided for taking the town supply either from the delivery well direct or from the reservoir. It is proposed that the delivery main shall eventually be a 24-inch iron pipe to the town and camp. The mains and sub-mains and distributing pipes in the camp and city are of the ordinary description. In all streets where mains are laid, stand-pipes, bullock and street services, are to be erected.

The daily supply will be 25 gallons per head for 80,000 persons.

The present population of Karachi is 68,332, and its death-rate in 1881 was 21 per 1,000 for all ages, while the death-rate among European troops was 26·61 per 1,000 one third of which was due to enteric fever.

The report on the new water-supply is illustrated by plans and sections, one of which is of special interest in its bearing on the sanitary state of the troops there. It is a map of the station and surrounding country, on which is shown the average wind directions in relation to the position of the cantonments, of the town, and of marshy back-watered land. This unhealthy exhaling surface is many square miles in area. One side of it comes to within a mile of cantonments, and the whole area as well as the Native town itself lies to the windward of cantonments, which receive the wind blowing over both for 247 days in the year. We are afraid that these topographical conditions point to disease causes which admit of but one remedy,—removal to a better site. The question may be asked whether a site which would escape the marsh wind altogether might not be found somewhere about Ghizree.

40. These are the chief points requiring notice in the section of *General Remarks*. There is, besides, a long and useful detail of information on the subject of sewage irrigation with reference to the Poona drainage scheme at present under consideration. There is, further, a note by Mr. Hewlett, showing that since 1875 much good sanitary work had been done in Poona. There is also information about Bombay city water-supply, a matter belonging rather to the Bombay municipal report, and there are some details given on the subject of animal vaccination in Bombay, but these belong to the vaccination department.

41. We have said enough to show that Mr. Lumsdaine's Report for 1881 is one of much importance to the progress of sanitary work in Bombay Presidency. By a few test cases, he has shown what is probably the sanitary state of every large population group, and he has also shown by examples that, so far as water-supply is concerned, principles which have been long in use in England are applicable in India. As we have already stated, we should have been glad to have had some information as to sanitary work done in villages under supervision and advice of vaccination officers. But, so far as information is given in the present Report, we see no reason why the sanitary principles we have laid down in our revised "Suggestions" should not be taken as the foundation for improvements in towns, villages, and stations, and this is the practical result of the Report.

42. We desire to make only one other remark referring to papers submitted to us by the India Office, in which Mr. Lumsdaine discusses certain remarks previously made by us on passages in his preceding Report, about cholera. These remarks applied solely to matter of sanitary principle as distinguished from disease theory, and the explanation which Mr. Lumsdaine has given of those he himself made fully show that his views were not intended practically to differ from our own; and, in conclusion, we entirely adopt the following opinions in regard to the Bombay sanitary service with which the Government resolution on the Report under review concludes:—

"The Deputy Sanitary Commissioners, without exception, deserve the thanks of Government for the zeal which with their duties have been performed. As the Report under review is the last annual Report which Mr. Lumsdaine will submit to Government, His Excellency the Governor in Council takes this opportunity of recording his appreciation of the conspicuous ability with which that officer has discharged the duties of Sanitary Commissioner for more than 11 years. The ardent interest which he takes in his work is shown in all his annual Reports, and not least in that under review."

We may add to this estimate that Mr. Lumsdaine had to organise the Sanitary Commissioner's department for Bombay Presidency.

15th June 1883.

No. 4.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the
SANITARY COMMISSIONER for BENGAL for 1881.

1. The population of Bengal, of which the census of 1881 was taken, and not including certain outlying hill districts (Naga) was as follows:—

Males	-	-	-	-	34,220,905
Females	-	-	-	-	34,601,015
					<u>68,821,920</u>

On account of the absence of certain district details this total is under the truth by about 8,000. The population, excluding that of Naga hills, which should form the basis of vital statistics in future years is hence 68,829,920. That of the previous census of 1871 numbered 62,709,405, showing an increase in the decennial period of 10 per cent.

From among the census population of 1881, there were registered the following deaths:—

			Number.		Ratios per 1,000.
Males	-	-	686,825	-	23·02
Females	-	-	568,653	-	18·92
Total deaths			<u>1,255,478</u>		<u>20·96</u>

The total mean death-rate of previous years was 16·69 per 1,000, a fact which shows, not that the year 1881 was a specially unhealthy year, but only that the registration had improved, for it may be safely assumed that none of the death-rates hitherto registered represent the actual annual mortality.

Perhaps a nearer approach to the actual mortality is the average death-rate of 33·47 per 1,000 for 96 towns in the province of Bengal for 1881, against an average of 29·84 per 1,000, during the previous five years.

3. Registration of births was carried out in 1881 in 46 municipalities and towns, having an aggregate population in 1872 of 1,552,672. There were 20,608 male births, and 18,248 births of females registered; together 38,856 births, equal to a birth-rate of 25·51 per 1,000.

The distribution of birth and death rates among different districts and towns shows the usual variations which it is unnecessary to discuss, as their main result bears more directly on the condition of registration than on the actual facts.

Their teaching of course is, that efforts at present being made to improve the registration machinery and its agents require to be continued and extended.

Chief diseases.—The following proportions of deaths from the ordinary causes were registered in 1881:—

Diseases.	Total Deaths.	Deaths per 1,000.
Cholera - - - - -	79,180	1·32
Small-pox - - - - -	24,371	0·40
Fevers - - - - -	940,911	15·71
Bowel complaints - - - - -	57,029	0·95
Injuries - - - - -	21,655	0·36
All other causes - - - - -	132,332	2·21
All causes - - - - -	<u>1,255,478</u>	<u>20·96</u>

Under the head of injuries are included 9,502 deaths from snake-bite and wild beasts, a small part, no doubt, of the total mortality, but showing that there is room for considerable improvement in this part of the public health work.

There is the usual large proportion of deaths not assignable to any of the registration headings, but at present there is little prospect of any certain account of these deaths being obtained.

5. *Cholera.*—As epidemic cholera is a well-known disease among the people of Bengal, we may safely assume that the recorded deaths, 79,180 in number, represent approximately the year's mortality from this cause. The death-rate was 1·32 per 1,000, contrasting favourably with the average rate of 2·08 per 1,000, which ruled during the preceding five years. There was, nevertheless, a large increase of cholera deaths over those of 1880, which numbered 39,643. The death-rates per 1,000 since 1875 have been as follows:—

Years.	Ratio per 1,000 Cholera Deaths.
1875 - - - - -	1·80
1876 - - - - -	3·27
1877 - - - - -	2·58
1878 - - - - -	1·58
1879 - - - - -	2·27
1880 - - - - -	0·66
1881 - - - - -	1·32

Last year, 1880, showed the lowest registered cholera death rate on record. The cholera of 1881 was by no means equally distributed over the country. It was chiefly confined to the sea-coast from Poori along to the north-east, where it spread over most of the Ganges delta. The region traversed by the rivers Gundick, Ghogra, Ganges, and Sone, near their points of junction also suffered. The remainder of Bengal, that is, by far the greater area of the province, suffered very little. In the preceding table the cholera death-rate for seven years is given, and if the central year 1878 be left out, we find that the deaths from cholera in the years 1875-76-77 were nearly double the number of those which took place in the last three years of the series. This at any rate is a hopeful result.

Divided between the town and country populations the cholera death-rates in 1881 were as follows:—

Cholera deaths per 1,000.				
96 towns	-	-	-	3.01
44 country districts	-	-	-	1.25

The highest town-rate was that at Poori, which yielded 370 deaths from cholera out of 22,695 inhabitants, equal to 16.30 per 1,000. The highest district death-rate, 4.86 per 1,000, was in Balasore, in Orissa division. The total cholera death-rate of the year was made up not so much by severe local outbreaks, as by the wide area within which the disease showed its presence by a few cases. Thus out of 674 circles of registration cholera deaths were registered in 594, or an average of 133 deaths to each circle, but in these 674 circles there are 200,321 villages and towns, and of this great number of population centres all the cholera deaths were returned from 15,581 villages and towns, or a little over 7.7 per cent. of the number.

6. The following was the monthly distribution of the epidemic:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - -	3,999	July - -	6,758
February - -	2,616	August - -	7,155
March - -	7,119	September - -	2,409
April - -	18,434	October - -	2,711
May - -	10,833	November - -	3,674
June - -	5,324	December - -	8,158

These monthly numbers of course are merely averages; for the periods of attack and cessation of the disease differed considerably in different districts. It is certain, however, that the highest death-rates were yielded by the months of April and May.

7. It is not easy to trace any connection between cholera mortality and meteorological elements, as these latter are only available for comparatively limited areas. We shall adduce them, however, under the head of "fever," and show their relation to cholera at the same time. The general result was that dry months accompanied and preceded increase of cholera, and that cholera deaths declined after heavy rain.

8. But the chief agents in augmenting cholera mortality were local causes of the operation of which the following illustrations may be introduced:—

In a violent outbreak of the disease in the town of Burdwan, it was noticed "that those who drew their drinking water from the River Banka, a sluggish and filthy stream some 30 feet wide, into which several sewers open, and the banks of which are in some parts largely used for the purposes of nature, suffered the most."

The next illustration bears on the influence of pilgrims. The town of Ranigunge, in which cholera usually occasions great annual havoc, escaped in 1881, a result attributed to the pilgrims "not being allowed to enter it, and to the few who did so being induced to make a short stay." A question which suggests itself is whether the result was due to absence of "contagion," or to absence of crowding and its filthy accompaniments.

Here is another illustration of the same kind. "At Bankura cholera suddenly increases in July, when pilgrims from Juggernath pass through it, and that all the large and crowded places on the pilgrim route are first invaded by this disease. As this happens year by year the Civil Surgeon infers that the disease is introduced by pilgrims, and he suggests that, to establish this fact, halting places for them be provided, and their haltage be regulated, which if found insufficient to check cholera will at any rate provide better sanitation for them."

This, were it practicable, would amount to an additional step in the sanitary regulation of pilgrim routes, a subject we have often dealt with. The facts stated regarding Ranigunge appear to show that, on the supposition that cholera is introduced into towns as a "contagion," the few who entered the town ought to have introduced it, but they did not do so. On the other hand the experience at Bankura and other large towns entered by pilgrims, shows that crowding into the towns of persons subject to the conditions in which pilgrims travel may become a very potent cause of cholera in a district where an epidemic is always more or less active. The escape of Ranigunge, not from total absence of the pilgrim element, but from the absence of crowding and its concomitants, is proof of the same law of cholera. It is not necessary to set up quarantine, but it is necessary to prevent crowding of populous towns by predisposed people. It is not in introducing cholera, but in introducing themselves in large numbers among population groups, all of which are living on the border line between health, such as it is, and epidemics, that pilgrims are disease causes. But the Civil

Surgeon in Nuddea shows that the dangers of pilgrim overcrowding may be materially enhanced by local sanitary defects. He says that "the disease appears generally in places on the high road of either land or water communication, and invariably during the pilgrim season, continuing longer and causing a higher mortality in those towns and villages where the water-supply is impure and scanty, and the sanitary conditions most pernicious, especially when the excreta of the sick is thrown about, the dead burned near, or thrown into the sources of water-supply, and the infected clothing washed in the same."

Take another case where the pilgrim element was not present. "It was observed that the disease attacked with the greatest fatality the overcrowded and ill-ventilated localities of the town of Howrah, which suffered more than any other place." Its death-rate was 5 per 1,000, without pilgrims.

The case of Poori itself, the great pilgrim centre, illustrates the entire pilgrim case better, perhaps, than any other town. In times past it has exhibited an instance of a town of 23,000 inhabitants, liable to periodical influx of pilgrims, not only without any sanitary care bestowed on its residents, but presenting to the crowds of pilgrims arriving almost every conceivable exciting cause of outbursts of cholera. These outbursts require predisposition, which the pilgrims bring with them, and which those of them who do not die of epidemics at Poori necessarily carry away with them greatly augmented by the insanitary conditions of the place to swell the epidemic mortality by overcrowding, and added filth at places where they stay on their way to their homes. The Sanitary Commissioner states in regard to Poori that the cholera of 1881 "exhibited the same peculiarity in its incidence as in the previous year, viz., that it increased in activity at three different periods coincident with the influx of pilgrims to the Poori town, and that it spread generally in the district with their dispersion." On comparing the death-rate from cholera in Poori with the adjacent district rates the magistrate estimates "that the pilgrims cause a full half of the deaths from cholera occurring in the district among the residents."

The death-rate from all causes in Poori town in 1881 was no less than 95·65 per 1,000, and the previous five years' average was 55·58 per 1,000. Now if all the cholera deaths in 1881 were struck out there would remain 79·35 per 1,000 deaths, towards which, on the cholera pilgrim theory, the pilgrims could not have contributed. This enormous rate of 95·65 per 1,000 was made up as follows :—

	Death-rates per 1,000.					
Cholera	-	-	-	-	-	16·30
Small-pox	-	-	-	-	-	17·53
Fevers	-	-	-	-	-	23·57
Bowel complaints	-	-	-	-	-	21·19
All others	-	-	-	-	-	17·04

It will be evident that in 1881 the least fatal epidemic in Poori was cholera, and yet in dealing with the pilgrim question, it is usually the practice to leave all other epidemic diseases out of account, and as a natural consequence, pilgrim deaths on their routes are assigned to cholera.

There can be little doubt, we believe, that the entire epidemic mortality in this abstract must be traced to local and personal conditions to which residents at Poori are exposed, as well as to the influence of pilgrim crowding, but the crowding is apparently an important factor in the nature and extent of disease and death causes. There is, however, no reason why this result should be applied only in the case of Poori. As we have long contended, the pilgrim element is only one of those which lead to augmented mortality. It is nothing more than the element of overcrowding and increase of filth, added to already existing disease elements in these foul towns, and it would be contrary to all experience if augmented epidemic death-rates did not result. A glance at the epidemic death-rates in Poori given above almost raises the question as to whether the more obvious and rapid death cause, namely, cholera, by being so exclusively dwelt on has not been a means of turning the attention of sanitary improvers away from far more important death causes.

Here is a fact bearing directly on this question. "At Bankura 104 deaths occurred among pilgrims *en route* for Juggernath, viz., 9 from cholera, 27 from fever, 59 from diarrhoea, 8 from dysentery, and one from some other cause. Of these 36 died in hospital, 60 on the road, 1 in a lodging-house, and 7 in villages."

9. There are not many examples in Bengal where reduction of cholera mortality can be traced to sanitary measures, but the following cases may be noticed as hopeful.

The town of Decca, with a population of 69,212, had 85 deaths from cholera, equal to a death-rate of 1·22 per 1,000, while in other towns in the same division the rates were 3·11 and 7·24 per 1,000. For several years Dacca has had an improved water-supply which has been laid on to three fifths of the inhabitants.

Calcutta municipal and suburban show the same contrast as regards the prevalence of cholera as they have done in recent years. Municipal Calcutta has been main drained and supplied with pure water, and is, besides, undergoing general improvements, although very much remains to be done in the matter of foul water tanks and bustees; while suburban Calcutta, with its population of 257,149, remains in a condition similar to that of municipal Calcutta in the old time.

The cholera death-rate in municipal Calcutta was 3·9 (above the average), but the cholera death-rate in the suburban division was 7·4 per 1,000.

10. The influence of local topography on cholera mortality may be illustrated as follows:—In the Bhola subdivision in Backergunge, the disease prevailed the least. “The land here is the highest, and water accumulates and stagnates to a less extent in it than in the remainder of the district. At Monghyr, the Jumalpoore town suffered the most, representing a death-rate of 7·84 per 1,000 of population. This is a low-lying town at the foot of the hills, and during the rains the water rises to as near as two feet from the surface. Its surface drains are very filthy, and its wells more or less polluted.”

Among examples of reduced cholera mortality from sanitary improvement should perhaps have been mentioned the case of Durbhanga town, with 47,450 inhabitants, which lost only two people from cholera in 1881. “It is reported that by the great fires that occurred in Durbhanga town it underwent a sweeping purification.” The district death-rate was 0·15 and the town death-rate ·04 per 1,000 from cholera in 1881.

Bengal fairs under sanitary supervision enjoyed the usual immunity from cholera. The Sanitary Commissioner says that “as in the past two or three years, so in this, no serious disease occurred at any of the fairs; the few insignificant outbreaks that did take place are not worth recording.”

Experience obtained in 1881 confirms, but does not add to that of former years of cholera history. It shows the erratic nature of cholera distribution over a great region of India, and its presence in far greater intensity in some regions than in others, without any assignable cause. The intensity of the disease in localities was as usual influenced by local causes, certain of them connected with local topography, but, in the great majority of cases cholera being over the district, it swooped down wherever its presence was courted by insanitary local conditions; and experience of the results attending the removal of these conditions in well-defined instances is hopeful for future progress in improvements.

11. Facts in the present and preceding reports appear to show that the pilgrim question should be dealt with on broader grounds than cholera prevalence among them. This single epidemic disease affords the least reason for interfering with pilgrimages, because by far the largest mortality from preventable epidemic diseases among pilgrims *en route* and even at Poori, the great pilgrimage centre, has been shown in the present report not to be due to cholera. The percentages of 104 deaths among pilgrims going to Juggernath, and at Poori, their destination, was as follows:—

—	Pilgrims.	On Total Mortality, Poori.	Percentage of Epidemic Mortality, Poori.
Cholera - - -	8·65	17·0	20·1
Fevers - - -	26·00	24·6	21·7
Bowel complaints -	64·3	23·1	26·2

There is one consolatory fact to place alongside these figures, and this is that the same sanitary measures which will lessen liability to fevers and bowel complaints will diminish the risks of cholera; but if the facts be looked at solely from the side of cholera, and any of the numerous theories about it be relied on for guidance, we may rest assured that death causes among pilgrims and at places of pilgrimage will be left to operate just as if there were no disease theories at all.

12. *Small-pox.*—As already stated the registered deaths from small-pox in Bengal amounted to 24,371, or a death-rate of 0·40 per 1,000. Deaths from it were registered in 423 out of 647 registration circles, but in only 8,759 villages out of 200,321. Of the total mortality 72·04 per cent. took place in children under 12 years of age.

The highest small-pox death-rate of the year took place at the great pilgrimage centre, Poori; as already stated it was 17·53 per 1,000. The rural circle Gope in Poori also gave the highest death-rate from this disease of any rural circle. It was 15·70 per 1,000. The facts suggest the question whether the Juggernath pilgrimage had anything to do with these high local rates. The lowest town ratio was 1·98 per 1,000 at Bhagulpore, and the lowest rural circle ratio was 1·91 per 1,000 at Bustah in Balasore. The year's epidemic appears to have been made up of limited local outbreaks, to which 52 towns out of 96 contributed 1,461 deaths. Out of 44 districts, one only escaped the disease, and the others furnished 22,910 deaths.

Its monthly prevalence for the whole province is shown in this abstract.

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	2,592	July - - -	1,179
February - - -	4,000	August - - -	711
March - - -	4,490	September - - -	493
April - - -	4,357	October - - -	369
May - - -	3,182	November - - -	433
June - - -	1,879	December - - -	736

The epidemic appears to have passed over from December 1880, and it was most fatal in the dry and warm months.

13. The following was the vaccination staff during the official year, 1881-82 :—

Superintendents	-	-	-	-	8
Deputy superintendents	-	-	-	-	11
Native "	-	-	-	-	10
Inspectors	-	-	-	-	55
Head vaccinators	-	-	-	-	24
Vaccinators	-	-	-	-	379
Apprentices	-	-	-	-	73
Licensed vaccinators	-	-	-	-	739
Total staff	-	-	-	-	<u>1,299</u>

The total number of vaccination operations performed was 1,349,607, of which 11,976 were "secondary." The total number of successful primary vaccinations exclusive of those in the metropolitan area was 1,316,198 and of "secondary" 5,179

Total successful - - - 1,321,377

Of these total successful primary vaccinations, 11.41 per cent. were under one year of age, 63.13 per cent. were of one year and under six years of age, and 25.44 per cent. were above six years.

There was apparently a good year's work done. Estimated on the best available data the birth-rate of the year was 25.51 per 1,000. If taken over the whole population of Bengal the vaccinations would be under 2 per cent., but taken on the calculated births, the vaccinations would fall short by about 400,000. The data are, however, uncertain, and the work is very great. A table in the Report appears to show that in the population under vaccination the births ought to be about 1,319,716, but of this number under one year of age, 1,062,686 remained unprotected. The vaccinators have not yet succeeded in reaching the most effective ages for their work.

14. A fact or two may here be quoted to show how much epidemic constitution appears to be related to small-pox prevalence.

In Midnapore, "in the Contai thanna, where innoculation is practised, while 1,282 deaths from "small-pox occurred in 1880, not one death was recorded in 1881." For some cause or other small-pox inoculation was powerless in the latter year to induce the disease.

In regard to small-pox in Noakhalli district, "the Assistant Surgeon refers the outbreak to inoculation." Apparently something was absent in the Contai example which was present in the same year in Noakhalli. The only reference to local conditions as influencing small-pox prevalence is made by the magistrate about Raghunathpore, who remarks that "the town is a labyrinth of narrow "crooked lanes, and that it is no wonder that the disease, when it has once gained a footing, hangs "about the place."

15. *Fevers*.—There were registered under this designation no fewer than 940,911 deaths in 1881. This is the largest fever mortality yet returned, but the registration of deaths has been undergoing improvement, and no doubt part of the somewhat alarming increase of fever mortality is due to this circumstance.

The annual death-rates from fevers have stood as follows for the last six years :—

Years.	Registered Fever Deaths per 1,000 of Population.					
1875	-	-	-	-	-	6.14
1876	-	-	-	-	-	9.36
1877	-	-	-	-	-	11.85
1878	-	-	-	-	-	12.38
1879	-	-	-	-	-	10.37
1880	-	-	-	-	-	11.51
1881	-	-	-	-	-	15.71

The earlier ratios in this abstract are obviously due to incorrect registration, and it is doubtful whether the high ratio of 1881 includes all the fever deaths.

The lowest fever-rate of the year was registered in the district of Mymensing, namely, 5.97 per 1,000. From this point the mortality rises in districts and groups of districts to 6, 7, 8, 9, 10, 11, 12, 13, 14, and so on to 27.43 per 1,000 in Murshidabad. The highest rate of the year was in Nuddea, namely, 39.72 per 1,000.

The comparative death-rates in town and country registration circles were :—

	Fever Deaths per 1,000.					
Towns	-	-	-	-	-	18.84
Country	-	-	-	-	-	15.58

showing an excess of 3½ per 1,000 deaths in the towns; but on the other hand this may be partly due to better registration within town circles.

16. In the next abstract the monthly deaths from fever and cholera in 1881 are shown alongside the monthly climatic elements, but as these latter vary considerably in different regions of Bengal, the means of comparison are only of a general kind. Barometric data are omitted.

Months, 1881.	Deaths from Fever.	Deaths from Cholera.	Rainfall.		Mean Temperature.		Humidity.
			Of Year 1881.	Differences on Average.	Of Year 1881.	Differences on Average.	
			In.	In.			
January -	85,845	3,999	0·04	-0·50	62·3	-1·2	
February -	69,674	2,616	0·06	-0·88	65·3	+1·1	60
March -	64,453	7,119	2·88	+1·64	74·4	-1·9	59
April -	73,649	18,434	1·48	-0·85	77·6	+1·2	61
May -	66,216	10,833	6·41	+1·27	82·8	-0·7	72
June -	51,191	5,342	13·44	+1·30	81·7	-1·4	82
July -	60,171	6,753	13·56	-0·38	81·4	+0·1	84
August -	66,824	7,155	14·47	+1·38	81·0	-0·2	86
September -	72,487	2,409	10·87	+·34	81·2	equal	84
October -	100,321	2,711	4·10	-0·53	78·6	+0·2	75
November -	118,436	3,674	0·07	-0·41	71·0	-0·4	61
December -	111,644	8,153	0·13	-0·03	64·1	+0·1	66
Annual -	940,911	79,180	67·51	+2·33	75·1	-1·1	71



Taken generally, these data appear to show that low temperature, absence of rain, and dryness raised the fever death-rate in January and December, while they also raised the death-rate from cholera. The fever mortality was low when the air was dry. It continued low till the ground had received most of the year's rain, when the temperature was high and also the moisture, but when rain almost ceased, with falling temperature, dryness, and evaporation, fever attained its maximum. On the other hand, absence of rain, dryness and evaporation co-existed with maximum cholera mortality, which, however, fell immediately under the influence of cumulative rainfall and decrease of evaporation, but it again sensibly rose with decrease of rainfall and of temperature, and increase of evaporation.

With reference to fever causation, the relative climatic and mortality columns confirm what has been long observed in India, that the period of super-saturation of the ground with water-logging, followed by drying up and falling temperature, is the time of most active disengagement of the fever cause.

17. Excess of rain notably lessens cholera mortality, and some time ago we suggested, as a matter for inquiry, whether excess of rain did not operate in the causation, by improving the purity of all water sources. The object in view was, as far as possible, to analyse the compound facts, and to gain knowledge and experience to enable the predisposing causes of cholera to be more certainly grappled with. In the present report is given the result of a number of examinations of water samples made by the Civil Surgeon at Dacca district, but they can only be considered as tentative. Much more must be done before the question is decided either in one way or another; in the meantime we may quote the Sanitary Commissioner's summing up of results. He says,—“The general conclusion on ‘the influence of rainfall on limited water-supply such as that of wells and tanks is that the water, notwithstanding dilution, is unfit for use.’” This conclusion, if confirmed, would nevertheless show that some extent of purification might have taken place. Perhaps the best way to arrive at a practical conclusion would be to select a few wells and tanks here and there, to analyse the water at the end of the dry season and again in the middle or towards the end of the rains, and to place the results side by side in columns such as are usually employed in tabulating water analysis. We may recall the statement made in a former Bengal report, that, whatever might be the injurious effect of heavy rain, followed by water-logging of the subsoil, the rain introduced an element of improved health, by washing out and cleansing tanks and by replenishing wells. The question is a very important one, and might be settled in districts close to Calcutta.

18. But to recur to the fever death-rates. These were returned from all the 674 registration circles in Bengal. Out of 200,321 villages, fever deaths were returned from 141,976, but, considering the universal prevalence of fever causes, as indicated by the fact that every registration circle suffered, it appears doubtful if any village escaped attacks of the disease, at least.

In a former memorandum, we drew attention to the presence in statistics of fever mortality of a tendency towards a cyclical law of prevalence of fevers in the North-West Provinces. The Sanitary Commissioner for Bengal has dealt briefly with the questions in the present report, and has introduced a table showing the fever mortality in each of the divisions of Bengal, Orissa, and Chota Nagpore for the last 11 years; but they all lead to one result, namely, that the fever death-rate is increased generally by improved registration. Until a fair average record of mortality and its causes has been made available, there can be no basis on which to rest a classification of events, and, while registration is being improved, local meteorology would have to be rendered more trustworthy than it is at present, that is, its facts should be given locally, rather than generally for the whole country. One most important element in the discussion could be easily supplied in future reports, namely, the average monthly thermometric range for different districts.

19. The following facts given by the Sanitary Commissioner are sufficient to show the importance of recording more especially the leading meteorological elements:—

The excess of rainfall for the year was 2·33 inches, "but," in the Burdwan division, "there was an average excess of about 8 inches." The average fever mortality in Burdwan district is about 17 per 1,000, while, in 1880, with augmented rain, it was 23·65 per 1,000. In Midnapore, "the excess averaged nearly 20 inches," while the tables show that the usual fever death-rate, about 10 per 1,000, was raised to 17 per 1,000.

The 24-Pergunnahs had an excess of rain of about 10 inches, together with a registered fever death-rate of 16·18 per 1,000, against a previous five years' average of 14·48 per 1,000.

In Patna district, the excess was 10 inches, and the fever mortality of 1881 was 21·42 per 1,000; the previous five years' average having been 12·30 per 1,000.

But it does not follow that decrease of rain should be attended by decrease of fever, the fever cause may still be sufficient, under certain local and topographical conditions, to generate malaria under the influence of temperature and atmospheric moisture. The report furnishes examples of this relation among the climatic elements, and it follows that, in fever etiology as in all other similar questions, it would be unsafe to attribute the complex phenomena, which together make up a case of what is called zymotic disease to any one cause.

For example, in Mymensing district, in Dacca division, there was an average deficit of rain of nine inches, with a fever death-rate of 5·97 per 1,000, which was slightly in excess of the five years' average, viz. 5·86 per 1,000. In Rajshahiye and Cooch Behar division the rain deficiency was four inches. The division contains eight districts, in six of which the fever death-rate was augmented above, and in two diminished below, the average rate.

20. But, besides climatic elements bearing more or less directly on predisposition to fever, the report under review contains much important information regarding local fever causes.

In Bardwan a large proportion of fever deaths was attributed by the civil surgeon to pneumonia, "induced by damp houses and insufficient clothing." In one thana in Ranigunge nearly 90 per cent. of the people were attacked along the low-lying banks of the Damuda river. By the end of the month of October "drying up of swamps and stagnant pools was at its height, and it was at this time" and in November and December that the fever was most severe.

In Bankura "the severely affected localities were reported to be the most crowded parts of the districts, abounding in all the insanitary conditions favourable to the progress of fevers." In the most severely affected villages the magistrates found "a disproportionately large number of foul tanks" and a great deal of decomposed vegetation in them, making the water most unwholesome." In the same district the civil surgeon states that "growing insanitation," connected with increase of population, "are the special features of the country seriously affected by the disease." And in enunciating this view he has touched on a law of epidemics which is too apt to be overlooked when single or specific disease causes are held as ground of sanitary work. The law is, that when there is an established ratio of increase of population in any town, village, or district there must be a corresponding increase of activity in all sanitary procedure, because otherwise increase of population would imply increase of local disease causes, until a point is reached when further increase of population would involve degradation of type, and then the epidemic comes in to sweep away the surplus population, and matters again revert to their previous position. It is in this sense that epidemics are conservative at the expense of lives of people who ignore the conditions on which their tenure of life is held. In the case cited by the civil surgeon overcrowding and sanitary neglect go hand in hand, but increasing sanitary neglect without overcrowding leads to the same result, and in such cases too much or too little rain, abnormal temperatures and moisture, diminution of food supplies, may let loose the epidemic which will claim its victims as long as any susceptible subjects are left.

On the general influence of insanitary conditions in augmenting fever mortality, it will be sufficient to cite the case of Nuddea district. Fever statistics are given for all the 35 circles in this district, the general result of which is that the ratio of deaths from fever for five years, 1875-79, was 13·87 per 1,000. In 1880 the rate had risen to 29·98 per 1,000, while in 1881 it had reached the enormous proportion of 36·27 per 1,000. In one of the circles, Kaligunge, the fever death-rate, which had been 15·24 per 1,000 in the years 1875-79, rose in 1880 to 34·64, and 1881 to 69·40 per 1,000. It need scarcely be said that increase of rain would hardly account for this enormous mortality. There must have been some agency through which the rainfall and temperature acted. Of the nature of this agency the following account is given. The aggravating causes were "effluvia arising from cesspits, faecal polluted lands, decaying vegetation, and impure water. . . . During the past few years a gradual silting up of the small streams and their tributaries has been taking place thus these running streams become stagnant pools and hotbeds of pestilence in the dry season. . . . Again, the bunding of rivers, particularly in Chuadanga, to protect rice cultivation has done a great deal of mischief by confining the annual floods within the river beds. The effect of this ill-judged proceeding is to prevent the natural water flow from cleansing out tanks and other water sources, and to interfere with natural subsoil water movement. From this cause the mortality was excessively high in some villages, several families having been completely cut off, and there is scarcely a house that has not suffered."

There are several other examples of the evil influence of interfering with the natural course of floods by embanking, and we are glad to learn that Government had taken up the subject, and appointed a Commission to investigate the facts, and introduce remedial measures as far as practicable. The report of this Commission had not been made public, and we must wait for it; but it may not be out of place, as part of the year's disease history, to introduce the following points:—In certain villages in Nuddea "the people ascribe their unhealthiness to the insufficient rise of the river, for the past two years, which did not overflow the embankment, and wash out the villages effectually." In certain circles "the inhabitants themselves attribute the fever to drainage being obstructed by Government embankments." A thana in Serampore suffered severely, and "the direct cause of

"the severe prevalence of the disease is referred to the Damuda embankment, just outside, which prevents the washing out of the pits and tanks." In regard to this place it is further stated that "Mr. Carstairs, the sub-divisional officer, appointed a punchayet at Rajbulhat, who worked hard to get the drinking water tanks properly cleaned, to have the jungle around the tanks and pits properly cleaned, and to provide good drainage. . . . It is observed that the prevalence of the disease in this place has since stopped." The punchayet, it will be observed, had done the work of a flood, and although one such case cannot establish a practical rule, it shows that what one official has done could be done by others.

21. The influence of embankments for roads and railways on the amount of fever has often been discussed. In the present report the civil surgeon of Birbhum states that, with boundaries defined by railway lines before us "nothing can be easier to jump to the conclusion that fever and railroads are intimately associated with each other as cause and effect." He doubts the conclusion, however, and says very properly that "we must wait for further information." The countervailing considerations he mentions, such as the absence of excess of fever in other years in the same districts, want of direct proof of causation, &c., are no objections to the general principle he has stated; but we must wait the result of official inquiry.

22. One important practical result may, however, be considered as already arrived at, and this is that whatever allowance may be made for climatic influences, and these are undoubtedly of great importance, and whatever may be the result of over-irrigation, silting up of water outlets, and water-logging of subsoils, there is a whole class of fever causes which can be at once grappled with, and chief amongst these are village and household filth and foul drinking water. Let immediate steps be taken to cleanse and keep clean villages and houses, to cleanse out foul water tanks and wells, and to protect them from pollution, and we may rest assured that a considerable amount of the great fever mortality will cease. Atmospheric causes may influence the number of fever attacks, but the extent to which these attacks may prove fatal is mainly dependent on purely terrestrial and local conditions over which we have control. We can cleanse and keep clean our dwellings and surroundings, we can protect water sources from impurity, we can keep the drainages of the country open, and we can relieve water-logged subsoils by drainage; we can so construct even the humblest dwelling as to avoid damp floors and damp walls without cost, and people who at present sleep on damp floors may be induced to raise their beds in some way above its level.

If these things be done, and suitable provision for keeping cattle in their proper place be made, other things are sure to follow, such as better working power and better means for providing against atmospheric changes by food and clothing, and as a necessary result there will be a great reduction of fever and general epidemic mortality.

In India as elsewhere, the great physiological law must be recognized and acted on, that, in whatever climate we live, it is an imperative part of every day duty to adapt our habitations and personal living to its requirements. The danger lies in ourselves, not in the climate.

23. *Bowel complaints.*—The following abstract shows the monthly prevalence of these diseases in 1881:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - -	4,965	July - -	4,666
February - -	4,514	August - -	5,028
March - -	4,888	September - -	4,720
April - -	5,345	October - -	4,367
May - -	4,898	November - -	5,008
June - -	3,560	December - -	5,585

The total deaths from bowel complaints, chiefly diarrhœa and dysentery, were 57,029, equal to a death-rate of 0·95 per 1,000 on the registered population. These deaths were extensively prevalent, and were registered in the 674 circles, with 24 exceptions, but only 23,250 villages, out of 200,321, returned deaths. The facts show that there is still considerable uncertainty in the registration.

The lowest circle death-rate was 3·51 per 1,000 in Bankipore, in Patna district, the highest was registered in Busta circle, in Balasore, namely, 8·79 per 1,000. Of towns, Poori had the highest bowel complaint death-rate, 21·19 per 1,000, a ratio which exceeded the cholera death-rate in the same town, viz., 16·30 per 1,000. The highest registered death-rate of the year from cholera and bowel complaints both took place in the same pilgrimage town, a fact apparently showing some connexion either between the diseases or their causes. The rainy and cold months in this, as in previous years, yielded the highest bowel complaint mortality, showing the evil influence of surface chills, connected with deficient shelter and clothing (amongst other things), on the amount of bowel diseases.

24. *Injuries.*—Under this head are included 2,428 suicides, 1,274 deaths from wounds, 8,451 accidental deaths, and 9,502 deaths from snake-bites and wild beasts. The last item is the largest in the account, and shows clearly the great need of affording increased protection to the people from this death cause.

25. *Other Diseases.*—Not much can be said of this heading, except that the causes of 132,332 deaths, equal to a death-rate of 2·21 per 1,000 of the population, cannot yet be classified, and it is too early in the progress of Indian registration to expect that they should be so.

26. Before concluding this account of the disease history of 1881, we shall notice briefly the facts of cantonment and port of Calcutta death-rates.

Cantonments.—Returns from 12 cantonments in Bengal give 699 deaths out of an average aggregate population of 34,063, or 20·52 per 1,000, or 3·20 above the ratio of 1880. Of the year's death-rate fevers yielded 12·68 per 1,000, cholera, 1·17 per 1,000, and bowel complaints, 1·14 per 1,000. Deaths ought to be more correctly classified within cantonments than among the general civil population, and, if this be so, we have a high fever death-rate among a population which ought to be under practicable sanitary control.

27. *Port of Calcutta.*—In 1881 this port was visited by 16,672 seamen, of whom 14,328 were Europeans and 2,344 natives. But the average port population of 1881, as determined by the same year's census, was 2,791, or about one fifth of the entries, which would perhaps afford a safe method of estimating the population for statistical purposes in the absence of a census enumeration. The following abstract gives the total admissions and deaths from among the entries for 1881 :—

Diseases.	Admissions.	Deaths.	Deaths per 1,000.	
			On Numbers visiting the Port.	On the Port Population.
Cholera - - -	51	34	2·87	12·1
Diarrhœa - - -	116	3	0·17	1·07
Dysentery - - -	107	4	0·23	1·43
Fevers, Enteric - - -	7	4	0·23	1·43
„ Malarial - - -	180	4	—	1·43
„ Simple - - -	197	—	—	—
Sunstroke - - -	9	3	0·20	1·07
Scurvy - - -	20	1	0·05	0·36
Others - - -	1,112	19	1·33	7·00
Total - - -	1,799	72	5·02	25·80

This includes all the deaths in and out of hospital. Of the former there were 65, and of the latter 7,—72 in all. The facts have an important bearing on the question of quarantine, for these European seamen entered an area within which the following casualties took place among a native floating population of 25,409 :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera - - - - -	70	2·75
Dysentery - - - - -	3	0·12
Malarial fever - - - - -	33	1·30
Scurvy - - - - -	1	0·04
Small-pox - - - - -	2	0·08
Others - - - - -	32	—
Total - - - - -	141	5·54

But, besides these deaths on board native vessels, there were 321 admissions to hospital and 52 deaths from among the same population, so that to make the ratios correspond with those for European sailors, both classes of admissions and deaths must be added together, and hence 25,409 of floating population yielded in 1881 the following deaths :—

Diseases.	Deaths.	Deaths per 1,000.
Cholera - - - - -	86	3·38
Dysentery - - - - -	9	0·35
Malarial fevers - - - - -	35	1·37
Scurvy - - - - -	1	—
Small-pox - - - - -	4	0·15
Sunstroke - - - - -	1	—
Others - - - - -	57	2·24
Total - - - - -	193	7·59

These abstracts regarding the native floating population show clearly that many cases and deaths take place which cannot be registered, and hence the facts are not comparable with those regarding the European seamen. They are sufficient, however, for the object we have in view. They show that, among the river population, 86 died of cholera in 1881. The ratio was 3·38 per 1,000. During the same year, the cholera death-rate in municipal Calcutta was 3·9 per 1,000, and in suburban Calcutta 7·4; and into a region where cholera prevailed to this extent there came in the course of the year 14,328 European seamen from the ocean, where there was no cholera, and 51

took cholera, of whom 34 died. The case is one diametrically opposed in its circumstances to the case of healthy ports where quarantine is declared against arrivals from cholera-infected ports, or from ports supposed to be infected. Healthy persons arrive in a cholera-infected port and city, they enter the city, and in doing so come under all the possible risks of local infection, acting on healthy people, and this (be it observed) is perhaps the greatest of all risks that can be incurred when epidemic cholera prevails, and the deaths amount to 2·37 per 1,000 of these arrivals. The essential condition, as has been proved by all experience, is that cholera should be in the locality into which healthy seamen come. Now, let us follow these men on their homeward voyages. First, they leave the cholera port where one man in every 421 who entered it died of cholera. It is another long known fact that the most effectual remedy against cholera attacks is to leave the locality where it exists, and this is precisely what is done; but it sometimes happens that a man already under the influence of cholera is taken ill at sea, while the others escape. In the great majority of cases, however, there is no cholera on board homeward bound ships, and, as all these arrive at ports where there is no cholera, surely there ought to be no fear of importing that which all experience shows is not there to be imported, and which cannot even exist without an epidemic and local favouring conditions. Should we expect healthy men to be attacked on landing in a healthy port? The question answers itself. There is absolutely no ground, either in fact or reason, for placing healthy ships in quarantine. The only possible ground, not for quarantine, but for ordinary sanitary precautions, is where a ship has had cholera on board, because in such a rare case, there may be a presumption that bad management may have led to local causation, for we now know that, without favouring local conditions, there can be no cholera, even in an epidemic region. When an epidemic is moving, all neglected population groups in its course are liable to be attacked, and unwholesome ships among others; but it is known that, even in these days of rapid voyages, the epidemic will, at times, head the ships. Thus, during the moving epidemic of 1865, while steam vessels were plying between Alexandria, where cholera existed, and Malta, and were placed in quarantine when they arrived there, a fatal case of cholera, the first in the island, followed immediately by others, took place in a soldier's child three days before any passenger in quarantine was affected with diarrhoea, and eight days before any case of cholera was "imported" at the lazaretto. The epidemic had travelled faster than the steamships. But the most telling experience was that afforded by the quarantine imposed at Gibraltar and Malta, after the epidemic had covered the west of Europe, rendering all the ports "suspected."

The quarantine authorities at Gibraltar were compelled, for local reasons, to put arrivals from suspected ports in quarantine, and 634 vessels, amounting to 323,409 tons, were dealt with in this way, while at Malta 1,008 vessels, of 502,507 tons, were quarantined. At Malta, two coasters, which had cholera on board coming from Italy, were sent away. Among none of the quarantined vessels at Gibraltar and Malta was there a solitary case of cholera. There were two cases of diarrhoea on board a pilgrim ship at Gibraltar, and eight cases of diarrhoea on board ships in quarantine in Malta, all of which, except one case, took place while cholera was in the garrison.

These facts were published in detail as far back as 1867, and it may not be out of place to reproduce the aggregate results now on account of recent quarantine proceedings against Indian seaports.

28. *Sanitary works (Civil).*—This section of the Sanitary Commissioner's Report is the most important, because of the information contained in it regarding the year's sanitary work.

As already stated, there are in Bengal 34 districts within which improvements are more or less in progress, with a total population, in 1881, of 68,829,920. Within these districts are 182 municipalities, including 96 towns, the population of which, 10 years ago, was 2,355,165, but probably not far from three millions at the present time. The remainder of the district population occupies 200,321 villages within which the real sanitary work has to be done, except works of general drainage and water supply of districts.

The aggregate income of municipalities and unions, in 1881, was 279,120*l.*, which was, for public health purposes, expended as follows :—

	£
Conservancy and latrines - - - -	16,976
Conservancy establishment - - - -	29,187
Drainage - - - - -	5,755
Water-supply - - - - -	2,590
Disposal of dead - - - - -	558
Markets and slaughter-houses - - - -	633
Vaccination - - - - -	930
Treatment of sick - - - - -	7,116
Other sanitary works - - - - -	3,068
Roads - - - - -	45,199

To the three fundamental sanitary works, cleansing, draining, and water-supply, there was allotted 54,508*l.*, not a very large amount, but still showing, in its apportionment, that cleansing is receiving additional attention, as the expenditure on it exceeded by 10,000*l.* that of 1880.

Some account is given of the works on which outlay was incurred, but their general character will be sufficiently understood from the preceding abstract of expenditure.

Besides these proceedings, important sanitary improvements have been initiated and carried out by district officers, which may be separately noticed.

"In Burdwan, Mr. Caspersz, the sub-divisional officer of Ranigunge, has paid, and is paying, great attention to village sanitation. His endeavours are directed to having refuse heaps properly

"dealt with, holes and small pools filled up, drinking water tanks reserved and kept clean, drains cut in village lanes, and the latter levelled, &c. This is done through the villagers, and some success has attended his action."

At Bankura, Mr. Anderson is continuing his efforts to improve the sanitary state of the people by cleansing water tanks, and improving roads and drainage. "Preservation of tanks for different purposes is now, he reports, readily attended to by the people, and with very little help from the authorities." He is preparing the ground for more extended operations in these matters. In Serampore, Mr. Carstairs "generally works through the punchayets in matters relating to sanitation," and in places not having these officials he has appointed sanitary punchayets. He has succeeded in raising large local subscriptions for improving village roads. Increased interest is taken in localities in sanitary work, and in some places they are working for the public good. Such a state of things, he remarks, "is an accomplished fact in more than one populous section outside municipalities in his division."

In Murshidabad, the magistrate, Mr. Moseley, had been able to prevent river pollution by dead bodies, and fouling the river banks.

Mr. Porch, magistrate in Maldha, has been doing what can be done, with the funds at his disposal, in the way of drainage, clearance of jungle, removal of insanitary surroundings of houses, &c. "He had much to contend with in the apathy of the people; but he has taught the zemindars and their almas, and the leading villagers, as far as practicable, the advantages of effectual drainage, and of careful use of good drinking water, and keeping their houses and their vicinity free from foul accumulations."

On the other hand the deputy magistrate of the Terai, in Darjiling, is said to have explained all these matters to the leading jotedars "without effect;" a similar result appears to have followed advice given at Shahabad by the magistrate, Mr. Nolan.

Although the proceedings of local magistrates have as yet covered only a small area of country, still it is satisfactory to find that there are cases in which the people have been led to help themselves, and we are glad to learn that native proprietors have in a few cases begun to interest themselves in the sanitary state of their properties.

29. Under the head of *General advance in Sanitation*, the Sanitary Commissioner gives a summary of the year's work done in a large number of towns and other localities in all the Bengal districts. The nature of this work will be sufficiently understood from the detail of expenditure already given, but there is one item in regard to Patna towns of such a character that we may quote the statement, as showing one of the first steps taken in a large town in Bengal, so far as we know, in carrying out one of the most important sanitary improvements. The summary states that, "at Patna, the Commissioners have agreed to the introduction of the house scavenging system again, steps were being taken to bring it into effect, and it has been decided to suppress a large number (about 5,000) of well privies, mohullah by mohullah." A similar decision will have to be taken and carried out within the area inhabited by nearly every population group in India before the subsoil can begin to recover itself after centuries of pollution. The fact of there being 5,000 of these well privies to be done away with in one town speaks volumes on the local reasons of Indian epidemics of cholera and fever, and their connexion with foul well water, polluted subsoil, and foul atmosphere within and around dwelling-houses.

Considerable improvements in this direction have been already carried out in Dacca town, in which we are told that "well privies were actively suppressed." Two thousand private latrines, to be cleaned by municipal sweepers, had been provided instead of well privies, and the work was still proceeding. Similar work was being done in many other towns.

The question of improved water-supply was also receiving attention.

"The Eden canal project, whereby good water is available for the town of Burdwan, Hughli, and the country through which the canal passes, was completed in December."

The water is to be laid on to Burdwan by pipes. It is in contemplation also to reopen the old Gangoor river in the Burdwan district, by which a large tract of country will be drained and supplied with water. Dacca water supply is to be extended. Schemes for supplying suburban Calcutta with water were under consideration. One had apparently been approved on account of its greater cheapness, but it "seems to be much inferior as a sanitary measure," says the Sanitary Commissioner, and if his view be correct it may safely be predicted that, like other cheap work of the kind, it will cost the ratepayers more than the presumed saving over a thoroughly efficient scheme.

The Govindpore lake in Manbhum has been formed by private subscriptions, and will supply good water to a large population, and to travellers on the Grand Trunk road.

In the Bogra district six water supply tanks had been dug by private subscriptions.

Drainage.—The main drainage channel and its branches in Dinagepore district was completed. It cost 5,734*l*. Drainage works had been completed in other places, and a scheme was under consideration for draining a part of suburban Calcutta. In this district great improvements had been carried out on bustees.

The Government of Bengal appears to have entered thoroughly into the public health questions. The Bengal Municipal Act was extended to a number of towns, including the great pilgrim cholera centre Poori. The Act empowering commissioners to regulate public and private latrines had been extended. But perhaps the most important step taken by the Government has been to relieve municipalities, stations, and unions in Bengal of all police charges.

"The effect of these orders," says the Sanitary Commissioner, "will therefore be to give them a grant of three and a half lacs of rupees per annum." And the intention of this concession is, "that

"this amount shall be expended on sanitation, and other works of improvement, and on education." The great difficulty in sanitary progress, namely, want of funds, "has thus to a material extent been removed." In the course of the year further measures were taken for improving the health of the port of Calcutta by preventing defilement of the river banks. The Sanitary Commissioner sums up the year's work in the following words:—"Generally, fair progress has been made in sanitation, particularly with regard to drainage, the cleansing of the abominable private privies by the municipal mehters, instead of by private mehters, and the construction, metalling, and improvement of roads."

Appended to the report is an abstract of inspections of 28 towns made in 1881, stating briefly under separate heads the defects observed, suggestions made, and the action taken on them by the local authorities. The results have been briefly noticed in the preceding pages.

30. In summing up the results of the report under review, we are desirous of stating that the Sanitary Commissioner has bestowed much pains on it, and has continued his work in the same practical direction as he showed in his report for 1880.

There is still, of course, the great statistical difficulty to deal with, for as the Government of Bengal has observed in its resolution, "In considering the statistics given of the mortality from the principal diseases, it is necessary to bear in mind that they are not even approximately correct as a whole. Of the actual mortality throughout the area under registration they give no indication."

Cholera mortality is, perhaps, the least inaccurately reported, as this is a well known death cause among the people.

Any way there is no question that, except in some towns, registration requires almost as much improvement as sanitary condition.

Taking the facts stated by the Sanitary Commissioner, there can be little doubt as to the disease causes which must be dealt with before those epidemic pests are reduced to their lowest practicable level.

There are atmospheric causes which cannot be directly dealt with, which may be considered as pre-disposing causes of all of them. These are shown, although very imperfectly, in the abstract tables we have given above. But of far greater moment to the public health are terrestrial, local, and personal causes, all of which are more or less under human control. The drainage outlets of areas of country can be improved and kept open, and stagnation of subsoil water can be more or less effectively removed by drainage works.

Foul water sources, whether in tanks, wells, or streams, can be improved and protected, or, if necessary, replaced by others. Water holes and broken ground in and about towns and villages can be filled up, drained and levelled. Towns and villages can be surface drained at small cost, and with great benefit to health. But the great cause which aggravates the severity and fatality of all Indian epidemic and endemic diseases is simply filth. If every town and village in India were cleansed, and kept clean in its open spaces, streets, lanes, and houses and house compounds, and cattle housed away from human dwellings, we should hear little of these epidemic diseases which at present decimate and destroy the working power of the people. This is the sum and substance of the present report.

We would at the same time acknowledge thankfully the good which is being done by the Government and its various officers and agencies in improving the sanitary condition of the vast population entrusted to its care. But there is one subject of regret, and this is, that the present report affords no indication of any work done by the vaccination officers during their numerous village inspections in trying to make the people improve their houses and surroundings, so as to improve their health.

13th June 1883.

No. 5.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the PUNJAB for 1881.

1. The population returns obtained on the census of 1881 were not sufficiently classified when the present report was prepared, to be available for the calculation of ratios on the usual forms. There is, however, a district abstract given by the Sanitary Commissioner in which the population under registration, and exclusive of military cantonments is stated at 18,676,032, the births at 695,766, and the deaths at 519,779. The birth-rate of the year was in round numbers 37 per 1,000, and the death-rate 28 per 1,000. Both ratios show a very considerable improvement in registration, for the registered births exceeded the numbers of 1880 by 151,107, and the registered deaths were 47,948 in excess of the preceding year's number. Out of 32 districts, Kohat and Dera Ghazi Khan had the lowest death-rates, namely, 15 per 1,000. The highest district death-rate, 47 per 1,000, was registered in Amritsar, on the causes of which we shall have some important facts to state in the sequel.

2. Registered birth and death-rates were much higher in the municipal towns, and averaged in 52 of the larger towns 41 per 1,000 births, and 48 per 1,000 deaths. By far the greatest loss of life during the year, took place in the town of Amritsar itself; where out of a population of 136,166, there were no fewer than 16,984 deaths, equal to a death-rate of 125 per 1,000.

3. The following were the chief death causes in 1881, but the death ratios are calculated not on the population of that year, but on the preceding census population of 1875-76.

Diseases.	Deaths.	Death-rates per 1,000.
Cholera - - - -	5,207	0·30
Small-pox - - - -	6,749	0·38
Fevers - - - -	355,279	20·32
Bowel complaints - - - -	17,281	0·99
Injuries - - - -	5,695	0·32
All others - - - -	129,568	7·41
All causes - - - -	519,779	30·00

The actual registered death-rate on the population of 1881 was 28 per 1,000, and it follows that local rates are somewhat higher than they should be.

We shall give some account of these death causes in their order.

4. *Cholera*.—On the 19th September, 1881, the Government of India issued a very important order, appointing the following Committee to inquire into the history of cholera in the Punjab, and also in India generally, including the civil population and troops.—Colonel C. H. Hall, Commissioner, Rawal Pindi; Lieutenant-Colonel Stevens, Rifle Brigade; Major King Harman, D.A.Q.M.G.; Surgeon-Major H. W. Bellew, C.S.I.

The Government issued at the same time a code of instructions stating the points requiring investigation, and reminding the Committee that the object was of a purely practical character. “Mere theoretical discussions,” they say, “and quotations from works on cholera are not desired. “Whatever conclusions are advanced should be based on the facts adduced; every such conclusion “should be carefully framed, the evidence which appears opposed to it being weighed and recorded “as fully as evidence in its favour.” Recommendations are to follow the report of measures for protecting the public health from cholera in future years. We shall wait the results of this independent practical inquiry with much interest, and in the meantime Mr. Bellew has made the following statement about it:—“The report of the Committee is still under preparation, but all that “need be mentioned here is, that sufficient facts have been accumulated from all parts of India, to “enable us to see more of those conditions which favour the development of cholera in India. The “numerous statements and charts attached to the reports conclusively prove that cholera has its “special laws, which guide and govern its existence and prevalence, and that those laws or conditions “are not identical in all parts of India, but are evidently influenced by the conditions of climate and “locality.”

5. We shall next give the facts bearing on cholera prevalence in the Punjab during 1881. In our Memorandum on the Punjab cholera of 1879, printed in the India Office Sanitary Report, Vol. XIII., we gave an abstract of registered cholera deaths in the province for a number of years, to show the periodic character of local cholera epidemics, and we shall here continue it for the last ten years.

Years.	Registered Cholera Deaths.
1872 - - - -	8,727
1873 - - - -	148
1874 - - - -	78
1875 - - - -	6,246
1876 - - - -	5,736
1877 - - - -	29
1878 - - - -	215
1879 - - - -	26,135
1880 - - - -	274
1881 - - - -	5,207

The figures show irregular undulations in annual intensity. The monthly prevalence of cholera in 1881 was as follows:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	3	July - - -	183
February - - -	4	August - - -	1,649
March - - -	4	September - - -	2,560
April - - -	5	October - - -	545
May - - -	37	November - - -	38
June - - -	179	December - - -	1

This abstract has an important bearing on the relation of Hurdwar pilgrimage to cholera prevalence. The great 12th year's fair takes place in March, and because there is an augmentation

in and after April, it has been usual on cursory examination of the facts to attribute the increase to pilgrims spreading the disease. But the following abstract, showing the total cholera deaths registered month by month since 1867, which was one of the great fair years, and including 1879, which was the next and latest of them, shows that the law of cholera takes its own course irrespective of the great pilgrimages.

Total monthly deaths from cholera in the Punjab for 15 years, 1867 to 1881.

Months.	Total Monthly Deaths.
January - - - - -	285
February - - - - -	239
March - - - - -	460
April - - - - -	233
May - - - - -	18,862
June - - - - -	17,689
July - - - - -	15,424
August - - - - -	20,707
September - - - - -	16,616
October - - - - -	7,742
November - - - - -	1,249
December - - - - -	263

Of course, some allowance must be made for errors in diagnosis and record, but a period of 15 years diminishes the error, and gives approximately accurate results. As these stand they show that if the pilgrimages were abolished the monthly ratios would remain much as they are now. But this fact would not show that pilgrims going to and returning from the fairs would not suffer themselves, and inflict loss of life on villages if they crowded into them. They prove conclusively, however, that the great annual increase of deaths on and after April is not due to the twelve years' recurring pilgrimage.

6. In our memorandum on the Punjab Report of 1879, we called attention to apparent errors in diagnosis of cases of cholera in the first quarter of the year, and in the Report for 1881 Mr. Bellew again reverts to this matter, and gives the results of inquiry into the genuineness of the first 16 fatal cases reported in the latter year, from which it appears that five cases were cholera, and all the others of other diseases, but several of the deaths took place in a day.

It may be that a coming epidemic of cholera modifies other existing diseases, or it may be that the verification of cases is not always made by competent persons.

Mr. Bellew appears to consider the first diagnosis as likely to be the more accurate than the amended ones. It is a question of probabilities. Wherever the facts have not been verified by a medical officer, we have to trust to the general impressions of the people, but in adopting this principle, we cannot overlook another fact, that it is one applicable to all the deaths of an epidemic, and that the result of it would probably be to increase considerably the registered cholera mortality at the expense of the other statistical headings in the returns. There is no way at present out of this difficulty. It must be remedied by improved diagnosis and more accurate registration. At present the registered facts must be accepted for purposes of comparison.

7. In the abstract already given it will be seen that the 16 fatal cases referred to occurred in the first four months of the year, and that the epidemic really began in the month of May. It attained its maximum in September, and died out in December. Out of 32 districts eight had no deaths registered from cholera. Out of 446 registration circles, all the deaths were returned from 121. But perhaps the most remarkable feature of cholera distribution was afforded by the fact that 5,207 deaths, which made up the epidemic of the year, were registered from only 371 villages out of 34,973. The epidemic showed itself in greatest intensity in Lahore district, where 18 out of 21 registration circles returned cholera deaths. In this district, 116 centres of population out of 1,672 yielded 1,643 deaths.

The city itself had no fewer than 772 cholera deaths, and as the Civil Surgeon attributed the Lahore outbreak to importation from Meean Meer, it may not be out of place to compare the facts adduced in proof of this view with the dates of attack. The first Lahore case given by the Civil Surgeon was in a man who was said to have been taken ill with vomiting and purging on 31st May, and to have died on 1st June. This case, however, is set aside. "On 5th June the disease broke out in the cantonment at Meean Meer," and on the 6th two young men went from Lahore to Meean Meer to see a friend who had been seized. They returned to Lahore, and were both attacked the same night, and one of them died, and then other cases are connected with these, and the Civil Surgeon says "that it is impossible, therefore, not to conclude that the disease was imported in the first place from Meean Meer, and spread therefrom." The relation of all the facts to each other could only be discovered by careful inquiry on the spot, and we have no means of testing the validity of the Civil Surgeon's view except by reference to dates in the present Report. He gives the date of the first imported fatal case as 5th-6th June. The Report gives the first fatal Lahore case as 6th March, and the first case of which the date is given by the Civil Surgeon died on 1st June, before the disease appeared in Meean Meer.

The following important practical remarks are made by the Civil Surgeon, Jullundur, on the subject of cholera quarantines:—"In the breaking out of cholera in a city quarantine seems to be the first dread in the eyes of the people, and their sole motive for concealment, because as soon as

" it became known we were going to do nothing of the kind, and intended to bring medicines to their doors, they willingly gave us information. Now that the epidemic is over, their gratitude was unbounded in that they were not dragged from their houses to be put into a quarantine hospital."

The Government of India have had recent troubles about quarantines against cholera, and cholera quarantines have been condemned in India by special inquiries. It may be suggested whether it would not be advisable simply to put an end to them. Anywhere, except in the few special cases where treatment cannot be effectually given in the patient's house, forcible removal should be everywhere abolished. The only real quarantine measure is one that every person must adopt for himself, namely, not to spend time in a locality where any epidemic outbreak has taken place longer than he can avoid. All else is sheer waste.

8. In the present Report Mr. Bellew has given a very complete account of the cholera of 1881 in its sanitary aspects, and hence this Report forms an important contribution to the sanitary history of the Punjab.

The epidemic nature of cholera is evinced by its distribution. It was much more intense in some regions of the country than in others, showing itself in greatest force in districts continuous with those of the North-West Provinces, while the western districts of the Punjab comparatively escaped the disease.

The influence of locality was clearly shown, and also the augmented severity of the disease due to local sanitary defects, bad water, and the like, errors in diet, unwholesome diet and fasting.

The following facts regarding the sanitary state of affected houses in Phillour are given by the Civil Surgeon:—"It was a harrowing sight to visit the low quarters of the town, such as Ali Mahalla, or treading one's way in and out of narrow passages and fearfully crowded dwellings, as in the Killa, often black and cobwebby, perhaps roof falling in and a running stream of rain drainage under the charpoys the patients were sleeping on. The scenes were calculated to terrify, when partly from desertion and chiefly from death it was as though one were in a city of the dead, the stillness only broken by the wailing of the mourners." In districts such as this, of which there are many all over India, there is but one available remedy when an epidemic is in the air, and this is removing the people, but it must not be forgotten that one main end of sanitary work is to root out such deadly localities wherever they exist. The present report shows that running away from infected villages into the jungle is a ready means of escaping from cholera, and it shows what the practice should lead to in special localities.

In 1879, the pilgrimage year, there were 88 cholera deaths in Jullundur, and the outbreak was attributed to the advent of pilgrims. There were no pilgrims in 1881, and "there was a regular explosion in the city." In August and September 421 persons died out of a population of 35,222, and 172 in the suburbs, out of a population of 15,702. The very unfavourable position of Jullundur, in regard to drainage and general sanitary arrangements, is well known, and the report states that "the wretched state of rain and damp that prevailed in the mud dwellings in which very many of the cholera cases occurred would hardly be believed." The rainfall in July and August was 23.48 inches, of which 6.86 inches fell on one day. "The air was laden with moisture and teeming with life all round the city. The Civil Surgeon says, we were water-logged by large accumulations of storm drainage."

The real remedy in such a case as this can only be applied by a skilled engineer.

9. The city of Amritsar suffered greatly in 1881 from two epidemics of fever and cholera which overlapped each other, and in numerous cases the two diseases were so confounded together, that it was difficult to distinguish the one from the other.

The following abstract supplied by the Sanitary Commissioner gives the monthly deaths registered in the city from each disease in 1881:—

Months.				Cholera.	Fever.	Months.				Cholera.	Fever.
January	-	-	-	—	209	July	-	-	-	—	171
February	-	-	-	—	154	August	-	-	-	45	286
March	-	-	-	1	170	September	-	-	-	328	2,652
April	-	-	-	1	189	October	-	-	-	225	4,279
May	-	-	-	—	193	November	-	-	-	8	2,540
June	-	-	-	1	231	December	-	-	-	—	950

A somewhat similar concurrence of two epidemics took place in Amritsar in 1869, but in that year the mortality from cholera was five times greater than in 1881, while the fever mortality was not much less than threefold in 1881 what it was in 1869.

The fever in 1881 appeared to be relapsing fever, "but with some affinity to cholera, and the two diseases masked one another so effectually that diagnosis was extremely difficult at times." The history of such cases is given as follows:—"Fearfully severe headache, insomnia, disordered bowels (often constipated), suppression of urine, and death by coma, frequently within a few hours after seizure of relapsing fever, but then the rice water evacuations and vomit of cholera appeared in very many instances during the course of the attack of fever. . . . In not one but 50 to 100 cases was the *materies morbi* (of the two diseases) observed to be operating in the same individual at the same time." Such attacks went by the name of cholera fever, and appear to have been confined to the interior of Amritsar, while malarious fever prevailed outside. We shall return to this subject while discussing the fever section of Mr. Bellew's Report, but it may be here stated

that the predisposing local causes appear to have been excessive rainfall without adequate drainage outlets. The whole subsoil of city and suburbs was water-logged, so that the subsoil water rose in springs above the surface, leading to disturbance of filth in the subsoil of the city and pollution of wells.

Concurrence of cholera with fever in the same localities and sometimes apparently in the same individual, or the modification of one epidemic by the presence of the other, have often been observed in India, and have at times led to an opinion that the two diseases were one and the same. There can be no doubt, however, that both epidemic diseases have been greatly aggravated at times all over India by similar insanitary local conditions.

10. Gurdaspur town, with a population of 4,137, yielded 30 cholera deaths in September. The town appears to be surface drained, "but all outside the wall is for the most part occupied by " stagnant pools, which increase in number in the rains; the dirty water of the town, therefore, is " not carried away, but on the contrary, it stagnates and contaminates the atmosphere here for a " greater portion of the year." Of course the remedy for such a state of things is to fill up all these holes and apply the street sewage for agriculture. A little ground area, and a few shovels ought to remove this source of danger. But, like all surface drained towns, Gurdaspur must supplement the surface drainage by a very efficient conservancy system, otherwise there will be cholera or fever, or both, when their season returns. The Civil Surgeon tells us that "in the smaller lanes and houses " urine and dirty water are, in most places, allowed to sink into the earth, or left to give off effluvia " which contaminate the air the townpeople breathe." Their clothing is described as "dirty, and in " some cases insufficient, dwellings confined, in most cases overcrowded and uncleanly, and in some " with open drains passing through them, one corner of the house being used for kitchen, the other " for a latrine, and perhaps a third for a cowshed. The filth in the latrines is suffered to give off " exhalations from one morning to another," or even to dry on the roofs. The well water is stated to be generally good, but in such a state of conservancy, this opinion would require confirmation by chemical analysis. This town has a municipal committee, and an income which appears to require being laid out to better purpose.

11. The town of Sialkote has a population of 32,989. Between 28th August and 17th October 1881 there were 211 fatal cases of cholera in the town, the maximum mortality coinciding with the maximum death-rate of Sialkote district, which was as follows :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	1	July - - -	1
February - - -	—	August - - -	6
March - - -	—	September - - -	272
April - - -	1	October - - -	32
May - - -	—	November - - -	—
June - - -	—	December - - -	—

Thirty-two villages in the district were attacked. The facts are important, because Sialkote has been somehow or other educated in the belief that quarantine can stay the march of a cholera epidemic.

The first town case took place in an insane beggar who had eaten immoderately, and drank a " quantity of filthy water from a pond of stagnant water. . . . This man had not lately been to " Wazirabad, Lahore, or any other infected locality, nor is there any evidence to show that this man " had any intercourse with any man coming from these above-mentioned places," but otherwise there appears to have been free intercourse between Wazirabad and Sialkote. It is important to remark that the first cholera death in Wazirabad town took place on 18th August, and that all the deaths, 54 in number, took place in August and September. The period of outbreak was the same as in Sialkote town, but if we take the two districts of Sialkote and Gujranwala, within which Wazirabad is situated, together, the history of the epidemic becomes clear enough.

Months.	Cholera Deaths.	
	Wazirabad.	Sialkote.
January - - -	—	1
February - - -	—	—
March - - -	—	—
April - - -	1	1
May - - -	—	—
June - - -	1	—
July - - -	—	1
August - - -	21	6
September - - -	221	272
October - - -	16	32
November - - -	1	—
December - - -	—	—

It is obvious that the epidemic law was the same in both districts, and that no question of importation would throw any light on the attacks. However, the Sanitary Commissioner tells us that every man in Sialkote "believes that the disease was imported here from Wazirabad." But he also tells us that "the circumstances attending the first cases were very carefully investigated, and not only is there no evidence to show that these cases had any direct communication with Wazirabad people, but as far as I know none of the latter who came to this city was subsequently affected by the disease." But suppose a chance case had been traced. Of course all the epidemic history supplied by statistics would have been set aside; or suppose the Sanitary Commissioner had postulated "contagion" as another Government officer in India did on a similar occurrence in 1880, of course the whole case would have been hopeless, and European quarantines against Indian ports would have been the logical result of a fallacy, and the municipal authorities of Sialkote would have felt justified in leaving the poorer districts in the following condition:—"The sanitary conditions of the house where the first case occurred were very bad indeed The natural drainage of Sialkote town is excellent, and the sanitary condition of the main bazaars and lanes was first-rate, but the houses as a rule were in a very defective sanitary condition, the cattle and the human beings being in many cases housed together. This was particularly noticed in Mianapora and Tibba Kakazayan, and it is to be noticed that the largest number of cases occurred only in these two mohullas. In the former there were 47 and in the latter 65 cases.

If the townspeople choose to adopt the quarantine theory, it is nevertheless the duty of the municipal authorities to cleanse the houses and to turn out the cattle.

12. These facts about the localizing causes of cholera in the Punjab are important, and they clearly show that although much has been done of late years to improve the Punjab towns, as is evidenced by reduced liability to cholera, there is plenty of work to be done by the new municipalities of a thoroughly practical character. In the Punjab, as in other districts of India, the great predisposing disease causes are to be found, not in public streets and places, but within the houses and compounds, and however clean and well-drained and paved a public street may be, it by no means follows that public health in low filthy damp localities will be improved thereby. This is a cardinal distinction to be observed in improving all towns and villages.

13. *Small-pox.*—Compared with other years the death-rate from small-pox in 1881 was the lowest on record. Calculated on the census of this year the rate was 36 per 1,000, but small-pox in the Punjab appears to have suites of years of high and low mortality. The highest registered number of deaths was 53,195 in the year 1869, the lowest was 6,749 deaths in 1881, but only two years before, in 1879, 49,489 small-pox deaths were recorded. Generally the months of August, September, and October are months of lowest small-pox mortality, while all the other months show considerable excesses of deaths. The following were the monthly deaths in 1881, and even comparatively few as these deaths were, there was a tendency towards the same distribution of deaths, as will be seen from this abstract:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	822	July - - -	531
February - - -	975	August - - -	238
March - - -	974	September - - -	246
April - - -	831	October - - -	285
May - - -	664	November - - -	237
June - - -	600	December - - -	356

Small-pox appears to have been most fatal in the western districts of the Punjab. Two of them, Peshawur and Dhera Ismail Khan, yielded 2,875 deaths; 93 per cent. of all the small-pox mortality was returned in children under 12 years of age. The total vaccinations performed in the Punjab during the official year 1881 were 458,915, of which 432,458 were reported successful.

The following abstract shows the small-pox deaths alongside the successful vaccinations performed during the last four years:—

Years.	Successful Vaccination.	Deaths from Small-pox.
1878 - - - - -	452,655	40,271
1879 - - - - -	430,720	49,489
1880 - - - - -	343,816	9,145
1881 - - - - -	432,458	6,749
Total - - - - -	1,659,649	105,654

The population yielding these results numbered 18,842,264 in 1881. In these four years 87.5 per 1,000 of the population were vaccinated successfully, and 5.6 per 1,000 died of small-pox. The results not having been considered satisfactory, the Government of the Punjab has re-organised the vaccination service under two circles, the eastern and western, in which the following staff has been sanctioned and distributed according to the necessities of each circle:—

Deputy Sanitary Commissioners	-	-	-	2
Native Deputy Superintendent	-	-	-	1
Supervisors of vaccination	-	-	-	20
Civil Surgeon's Clerks	-	-	-	31
1st class vaccinators	-	-	-	39
2nd class vaccinators	-	-	-	67
3rd class vaccinators	-	-	-	149
Total staff	-	-	-	309

We must wait the practical results of this improved service, but in the meantime not a day should be lost in employing this large staff in helping the people to improve their dwellings and surroundings which all past experience shows to be an essential element in diminishing liability to small-pox.

14. *Fevers.*—The conjoined mortality from cholera and small-pox in 1881 amounted to 11,956, equal to a death-rate of 0·68 per 1,000, a small matter when compared with losses from fever, which yielded 355,279 deaths, a death-rate equal to 20·32 per 1,000, or about thirty-fold the mortality of the other two epidemics. The present Report contains a detailed account of a test fever outbreak in Amritsar, which carries with it evidence as to local malaria, producing conditions almost if not altogether of strictly experimental character, but before discussing this case we shall give a general account of the fever and its causes, beginning with the monthly distribution of the mortality, which was as follows :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - - -	27,990	July - - -	17,423
February - - -	24,952	August - - -	17,249
March - - -	21,801	September - - -	34,396
April - - -	21,888	October - - -	56,868
May - - -	21,848	November - - -	49,203
June - - -	20,801	December - - -	40,825

It will be observed that there was a marked difference in fever mortality in different seasons. The month of maximum mortality in the preceding year, 1880, was October, when 35,762 fever deaths were registered. In November the registered deaths were 32,373, and in December, 31,973. In January 1881, the deaths as already stated were 27,990, from which number they fell in the succeeding months until August, when 17,249 deaths were reported, the lowest monthly mortality which had been registered for several years. But in the next month, September, the registered deaths were doubled, and the maximum mortality, 56,868, was attained in October, and during the last four months of the year, upwards of half the whole fever mortality of 1881 was registered.

Of general and climatic fever causes the most important are rainfall, temperature variations, and food prices. The influence of rainfall can only be considered in its general effects, because as we shall presently see, great aggravation of fever may ensue on purely local rainfalls, and in dealing with the Punjab question as a whole, the Sanitary Commissioner has given the month's aggregate rainfalls of all the observing stations in the Government. In 1881, the months of highest aggregate rainfall were July and August; and in and after September, when there was scarcely any rain, the great rise in fever mortality took place. The cumulative influence of previous rain took effect after the rain had ceased, and when two other elements came into operation, namely, evaporation and lowered and variable temperatures, but there is no information about these last elements in the present Report. The annual influence of cumulative rainfall is, however, well brought out in a diagram giving the relation of fever deaths quarterly; to rainfall every year from 1868 to 1881, with the following results. The total rainfall is not necessarily an index to the fever mortality; sometimes the fever deaths are more numerous with a less than with a greater fall, but in the entire series of years this important fact is brought out, that the maximum rainfall of each year, whatever the amount may be, takes place about the end of the third quarter of the year, while the highest fever mortality shows itself during or towards the end of the fourth quarter. The direct relation between the two classes of facts is further shown by another element, namely, that rapid increase of rain is followed by equally rapid augmentation of fever mortality, until the maximum of both for the year is arrived at. The rain curve quickly descends from its maximum and meets and crosses the ascending fever curve, which, as already stated, attains its maximum height in the quarter following the rain, and this element is connected with drying of ground and lowered and variable temperatures.

Food prices in 1881 were falling, but they were generally higher than in the years preceding the scarcity year 1878.

15. Fever deaths were registered in all the 32 districts of the Punjab, and every registration circle numbering 446, with a solitary exception, returned fever deaths. Of the villages, 34,973 in number, 27,946 suffered from fever mortality.

The lowest fever death-rate of any district was 8·39 per 1,000 at Simla, the highest, 34·78 per 1,000, took place in Amritsar district, and this high rate was connected with the Amritsar epidemic already referred to, which we shall describe because of its great importance to the fever history and fever etiology of India.

16. Amritsar district, excluding the city and suburbs, contains a population of 742,601. In 1881 it registered 17,201 fever deaths, equal to 23 per 1,000. Amritsar city, with a population of 136,166, yielded 11,724 fever deaths, equal to a ratio of 86.1 per 1,000. The suburbs of the city contain 6,449 people, of whom 37 died of fever; a death-rate of 6 per 1,000. As these very varying death-rates took place within the same area, we should naturally look for the influence of locality in the city, while the country death-rates would appear to indicate the operation of more general causes.

In the following abstract are given the actual monthly deaths in each of the three groups:—

Months.	Total Fever Deaths.		
	Amritsar City.	Suburbs.	Amritsar District.
January - - - - -	209	2	949
February - - - - -	154	2	677
March - - - - -	170	0	651
April - - - - -	189	2	511
May - - - - -	193	1	843
June - - - - -	231	2	870
July - - - - -	171	1	586
August - - - - -	286	2	703
September - - - - -	2,352	9	1,666
October - - - - -	4,279	11	3,715
November - - - - -	2,540	5	3,883
December - - - - -	950	0	2,147
Total - - - - -	11,724	37	17,201

The monthly details of rainfall are not given in the report, but it is stated, on the authority of the Deputy Commissioner, that in June, July, and August 62 inches were measured, of which 38 inches fell in July and August, being 24 inches above the two months' average. The Deputy Commissioner further states, that "the rainfall was not only abnormal in quantity, but singularly limited in area, " extending only a few miles on each side of the city of Amritsar." A fall of five feet two inches of rain in three months, over a limited area including a great city, must necessarily have led to important local consequences. It has been long known in regard to the city itself that the subsoil had become so saturated with filth, that all the well water was more or less polluted. The city lies on a lower level than the surrounding country, the surface drainage of which has been moreover obstructed "by " banks of high level canals and railroads," so that "the rain waters formed large swamps and " became absorbed into the ground, the result being an immense rise in the spring level. . . . " The hollow ground around the city and many gardens became flooded, and turned into lakes, the " water standing in them for months." The drainage outlets were insufficient, and outside the city the surface water mixed with the well water, and in some places subsoil water bubbled up to the surface. The whole subsoil in this way became charged with water, and "the rainfall broke up " and loosened and exposed the stratum of decomposing soil and vegetable matter which " always accumulates some feet below the surface of the ground in old cities in this country, and " flowing through it polluted the water in the wells." Excavations were made in 15 places inside the jail, and the subsoil water level was reached at distances varying from six inches to two feet nine inches from the surface. In August and September, the fever admissions in the jail, which had been 6.9 per 1,000 of strength in July, rose to 443.7 and 408.1 per 1,000. The Sanitary Commissioner states that, in a well in his own compound to which surface water had no access, the water rose within three feet of the top. The sub-soil was so water-logged that the foundations of buildings were sapped, and damp rose several feet up the walls, and as a general result of sub-soil saturation the city wells showed signs of sewage pollution. "The atmosphere was heavy and moist to an unusual degree, " while from the damp soil drying up under the influence of a hot sun, the ground water at the same " time beginning to subside, organic emanations from the decomposing animal and vegetable matter " contained in it must have been given off in great abundance."

17. Such, then, were the climatic and local conditions accompanying this Amritsar fever epidemic of 1881, but as usually happens the mortality may have been increased by unhealthy dwellings, defective clothing, and want of sufficient food; more than half the deaths took place in children under 12 years of age.

18. Surgeon-Major Bennett, Deputy Sanitary Commissioner of the Eastern District, has supplied an interesting report on the fever itself, in which he states, that "at a comparatively early period of " the outbreak the sickness was so universally prevalent, that not a single individual, native or " European, in the city and civil station appears to have escaped its attacks, nine tenths of the shops " are said to have been closed, and the work of the Government offices was carried on with the " utmost difficulty owing to the general prostration and fever."

The fever showed itself under the two principal forms, intermittent and remittent, to which latter form most of the mortality was due, but there were intermediate forms also. The vast majority of cases were intermittent, of quotidian, tertian, and quartan types. Enlargement of the spleen occurred during attacks, but subsided on intermission taking place. The fever was most fatal during the period of evaporation after rain, and began to decline in severity with diminution of evaporation.

No typhoid appearances were found after death, but rather those which accompany death from slow starvation, which, no doubt, was an important factor in the high fever death-rate. As already stated, choleraic symptoms were present in cases where fever "appeared to mask" cholera.

19. The history of this Amritsar fever is of great importance as showing the relation of local and personal causes to abnormal rainfall in the chain of events, while it yields an epitome of the action of fever causes over most districts in India. But it does more than this, for it shows in another form what relation to public health may at any time exist between canal irrigation without drainage and abnormal rainfall.

The late Civil Surgeon who examined the question addressed a report to the Commissioner in July 1881, before the fever assumed the epidemic form, in which he says that "it certainly appears evident that the great canals which irrigate this part of the country, as well as that around Meean Meer, as far as Changa-Manga, have slowly and certainly raised the subsoil water level, and have to a certain extent altered the conditions of climate. The level of the water is said to have been raised many feet higher than before the introduction of canals." The zemindars holding lands near the central jail have found that, whereas before the introduction of canals 100 lotas were needed for their water-wheels, they now find in 1882 that 70 lotas suffice. On the authority of the Secretary to the Municipal Committee, it is stated that in Amritsar and its suburbs, the canals have raised the well-water level permanently by six feet, and the available amount of well-water for irrigation has doubled.

As a general concomitant of this great rise in the subsoil water-level, it may be stated that, while in Amritsar district the death-rate from all causes had risen from a five years' average of 32 per 1,000 to 36 per 1,000 in 1881, in Amritsar city the previous five years' average of 61 per 1,000 had risen to the enormous ratio of 125 per 1,000, marking apparently the duplicate death ratio due to rainfall and to local insanitary conditions to which the city population had been exposed before the rainfall took place. Given local conditions under which a 6 per cent. death-rate takes place in Amritsar, and added rainfall to the extent of raising the subsoil water level to the surface, will raise the rate to 12½ per cent. The key to this result is to be sought in local sanitary defects within the walls rather than in abnormal rain distribution, and it is by dealing effectually with these unhealthy conditions that lowered susceptibility to fever in the city must be sought.

The city drainage must be so adjusted that, when the scheme being carried out is complete, it will keep down the water level as far as it may be practicable to do so, because it seems not unlikely that this level within the city depends on the water level of the surrounding country, as well as the rainfall within the city area. But one of the most important works required for protecting the public health is a good water-supply properly distributed, and the filling up of all the wells. At present no dependence can be placed on them for drinking or culinary water.

20. The country problem is one of much greater difficulty. The previous five years' fever death-rate in Amritsar district was 23·45 per 1,000, but in 1881 the rate rose to 34·78 per 1,000, and the added fever death-rate of 11·33 per 1,000 had no other apparent cause except the great rainfall over a district already supersaturated with infiltration from canals and obstructed surface drainage. It is more easy to define the reasons than to suggest practicable remedies for disease causes of this class. But if subsoil water level is raised anywhere by canals, it would appear as if the safest way of obtaining water for irrigation would be to raise it out of the subsoil rather than to float it over the surface from canals, at least in districts where the water level has actually been raised by infiltration. The natural drainages of the district should be restored where defective, and sufficient outlets provided for all added water, in order to secure that amount of movement in the subsoil water which is now known to be necessary for the health of all irrigated districts.

Mr. Bellew has very properly called attention to the fact that the Amritsar epidemic of 1881 is by no means a solitary event, but, on the contrary, he has shown by a table of fever mortality and rainfall for the preceding 14 years that more or less heavy monsoons take place triennially, and are followed by fever outbreaks in the city, and his conclusion is a perfectly sound one, namely, "that unless steps are taken to provide some such means as may drain away the immense volume of rain waters which at present stagnate in and about the city, and that not only produce deadly malaria, but by absorption into the filthy subsoil of the town site poison the already polluted well water, the recurrence of epidemics perhaps more fatal than the one from which the city suffered last year is inevitable."

21. It is not often in Indian sanitary history that so careful and minute an account of local fever etiology has been attainable. It has been long known that, other things being the same, excess of rain has been followed by increase of fever, but in the present case the evil has been traced step by step to its culmination in a 12½ per cent. death-rate, of which above 8½ per cent. was due to malarial fevers, and the history shows that, while great local excess of rain caused the fever, it did so on account of water-logging of the whole district leading to stagnant sub-soil water, want of drainage outlets, and in the city itself, foul well water and other sanitary defects. The whole case can be used anywhere in India as affording a clue to local fever outbreaks.

Bowel complaints.—Fatal diseases classed under this head showed a reduction of 3,455 deaths when compared with the mortality of 1880. The deaths presented the usual anomalies in distribution, as evidenced by the fact that, while 423 out of 446 registration circles returned deaths under this head, the mortality was confined to 6,099 population groups out of 34,973 in the province.

The highest district death-rate of the year was yielded by Simla, namely, 2·83 per 1,000.

The following abstract gives the monthly bowel complaint deaths, and it will be observed that the highest rates from this cause coincided with the highest fever death-rates which took place in the last four months of the year:—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	1,297	July - - -	1,208
February - - -	1,015	August - - -	1,389
March - - -	1,033	September - - -	2,025
April - - -	1,119	October - - -	2,265
May - - -	1,260	November - - -	1,914
June - - -	1,186	December - - -	1,620

But the highest local fever death-rate did not co-exist with the highest local bowel complaint death-rate. This latter, 7·84 per 1,000, took place in Hoshiapur town, where the fever-rate was 11·26 per 1,000. The next highest bowel complaint death-rate, however, took place in Amritsar town. It was 7·03 per 1,000, with a fever death-rate of 8·10 per 1,000, so that fevers and bowel complaints together nearly decimated the population.

There is nothing further under this head which calls for remark.

23. *Injuries*.—Deaths from injuries were 5,695, including 263 suicides, 4,231 deaths from wounds or accidents, and 1,201 deaths from snake-bite and wild animals, of which last 1,012 were from snake-bite and 139 from hydrophobia.

The recorded deaths from wild beasts were as follows:—Jackals, 6; wolves, 8; tigers, 2; alligators, 2; cat, 1; scorpion stings, 8. The causes of 23 others were not ascertained.

24. Under the head “all other causes,” there were registered 129,568 deaths, of which nothing is known except that they included the following monthly deaths from coughs and chest affections, which we here insert as an earnest of further advances in diagnosis.

25. Monthly deaths registered from chest affections, 1881:—

Months.	Deaths.	Months.	Deaths.
January - - -	3,518	July - - -	1,608
February - - -	3,435	August - - -	1,890
March - - -	3,185	September - - -	2,510
April - - -	2,497	October - - -	2,792
May - - -	2,142	November - - -	2,699
June - - -	1,800	December - - -	2,828

It is satisfactory to see that the deaths registered under this designation exceeded those so recorded in 1880 by 2,560.

26. *Sanitary works (Civil)*.—Under this section it is stated that the new waterworks, Lahore, had been completed and in satisfactory operation for seven months. The reservoir had given way, but the supply had not been interrupted, and was being pumped directly into the pipes, of which 22 miles had been laid in the principal streets of the city and suburbs. 167 stand-pipes had been put up, and more were in hand. 118 fire hydrants had also been put on the mains. Only 110 connexions had been made with the houses, but this is a beginning, and a progressive increase may be anticipated. An important point is that water is being used without any prejudices. Bistis draw their water at hydrants for distribution. The price exclusive of loan interest is about 2½d. (1a. 10p.) per 1,000 gallons.

In the absence of plans and other information in regard to the reservoir which had given way at Lahore, the only remark we desire to make is, that if the work had been properly planned and executed such an event ought not to have taken place.

New waterworks at Delhi and Simla were in progress, also at Ludhiana.

27. There are in the 32 Punjab districts 196 municipalities. The total income of 192 of them, including 103,271l. of previous years' balances amounted to 357,083l. The years' public health expenditure under the usual classified heads stood as follows:—

	£
Conservancy establishment - - -	38,911
Paving - - -	5,444
Roads and bridges - - -	22,380
Drainage and sewerage - - -	8,886
Water-supply - - -	8,562
Watering of streets - - -	4,361
Constructing latrines - - -	1,416
Repairs of ditto - - -	999
	<hr/>
	£90,959

The total amount expended for all purposes was 250,939 $\frac{1}{2}$., leaving at the end of the year an unappropriated balance of 106,144 $\frac{1}{2}$., of which a part might have been usefully expended on sanitary work. The proportional expenditure for different purposes stated in the preceding abstract includes that for roads and bridges, much of which would lead to no direct result on public health, and probably not more than 70,000 $\frac{1}{2}$ of the amount could have conduced directly to sanitary improvements. The amount is small, and it is to be hoped that under extended and improved local administration a larger amount of really useful work may be undertaken. It ought to be kept in view as a principle of municipal action that an unhealthy community is always a poor community, and public health expenditure is consequently one of the best and most profitable investments that can be found for municipal funds.

28. It would answer no good purpose to go into local expenditure details, the particulars of which are given in abstracts of local reports, and we shall simply notice a few points of interest in them.

Delhi.—A drainage scheme is before Government for sanction. Conservancy has been improved, and the city is said to be clean and healthy. It is not stated whether the cleansing extends beyond the streets and public places, but it will be evident that very considerable improvements require to be carried out from the fact that in 1881 the death-rate of Delhi was 48 per 1,000, while the previous five years' average was 63 per 1,000. Of the 48 per 1,000 no less than 30·72 per 1,000 was due to fevers. It appears as if a caution were necessary on the manner of disposing of the night-soil of this large city.

It is buried in pits and covered with earth. The ultimate object of this method of dealing with it ought to be to sell it for manure, but great care ought to be taken that no drainage from the heaps can enter any watercourse or pollute the subsoil near dwellings; care should also be exercised in keeping the places of deposit to leeward of houses, for there are no greater risks during cholera times than those which may arise from foul exhalations from these laystalls. In order to use this system with safety the pits should be water-tight.

Simla.—No conservancy scheme for the bazaar and station has yet been undertaken. The Deputy Commissioner states that "the large number of buildings being erected for public offices and residences for Government establishments make such a scheme every day a more urgent want." Neglect of this kind is quite inexcusable. The "sanitary history of Simla is well known, and unless the whole place be put in a habitable sanitary condition, Government officers will have to bear their proportion of loss from cholera as well as the bazaar people the next time this epidemic disease visits Simla."

Gujranwala district.—"No village committees have been appointed. The lambardars are held responsible for the cleanliness of their villages. Much attention has been paid to the village conservancy during the year under report. In large villages sweepers have been appointed, circular roads have been marked out, and mud pillars fixed in accordance with the suggestions of the Sanitary Commissioner and Civil Surgeon."

Mooltan.—The survey of this city has been completed.

Muzzaffargarh.—This division has suffered much from malarial fever, and the executive engineer of the canal division has carried out a drainage scheme affording 16 miles of outlet, so that "all the canals that used to swamp the tract traversed by the drain now tail into it. . . . The people have subscribed the labour from year to year, and the land was given for nothing." It is to be hoped that these swamped districts may now become less liable to fevers.

Peshawur.—The following singular method of conveying water for domestic use requires notice, and may repay careful looking into:—"The new channel, now almost complete, under construction in the city of Peshawur, has a central channel for drinking water and two lateral ones for sewage, the latter being on a lower level than the former." The Civil Surgeon has pointed out "the disadvantage of the water before it reaches the channel in the city being allowed to pass close to the Sadr Bazaar of the cantonment and other public places in the open streets." It was hoped that in a few days the cantonment would be supplied with filtered water by means of pipes; but what of the civil population?

All that we can do is to suggest that the parties who have carried out the city supply should be called on to justify their proceedings, and to state distinctly how they intend to protect the public supply from accidental pollution. We would at the same time recommend that no similar scheme should be sanctioned for any town in future.

In the smaller municipalities the principal improvements carried out are surface drainage, paving, cleansing, and improvements in wells.

29. Under Section X., "General remarks and personal proceedings," there is some information conveyed of high importance to future sanitary improvements in the Punjab. There are 202 middle schools, in the 3rd class of all of which Dr. Cuninghan's Sanitary Primer is now taught. It has also been distributed among the people and to all the vaccinators, and it is now part of the duty of the Civil Surgeon "to train the vaccinators under his orders in the elementary principles of general sanitation and domestic hygiene, so as to qualify them for employment as aids in sanitary work."

"The sanitary inspection of towns and villages in all parts of his circle visited during tours or journeys will form an essential part of the duties of a Deputy Sanitary Commissioner." Similar duties will be undertaken by Civil Surgeons for towns and villages. Both classes of officers have been directed to forward sanitary improvement in places visited by them.

To show that this inspection work is making good progress, the Sanitary Commissioner gives a list of 125 towns and villages inspected by Deputy Sanitary Commissioners and Civil Surgeons, between 1st April and 31st December 1881.

No doubt these outside proceedings are very important. They bring the facts and necessities officially before the people, and they introduce school children to new views in domestic sanitation and economy. But "there is a general consensus of opinion amongst the district authorities as to the necessity for some organized system of work in the matter of village conservancy, and some officers advocate the enforcement of the same by law."

This course the Sanitary Commissioner disagrees with, and purposes instead, "that the entire responsibility for the cleanliness of a village be thrown upon the lambardars, and that they be empowered to raise by private subscription or in kind, or by other means that may be considered most advisable by the civil authorities, a sufficient sum to enable them to maintain a fixed or permanent conservancy establishment of two or three sweepers;" and to give effect otherwise to the advice of the Civil Surgeon, he further suggests that official recognition should be given to zealous officers.

It is clear that whoever is saddled with this responsibility must be provided with funds or be enabled to provide himself with funds. We showed, in our notice of last year's report, that Mr. Bellew had brought village discussions up to the point that the people would do what was needed if they were ordered to do it.

However, it is satisfactory to know that the executive part of the question has been undergoing discussion with a view to its solution.

30. In the course of the year, as already stated, many towns and villages were inspected, and, as illustrations of this procedure and its results, certain details of sanitary defects observed, recommendations made, and works to be carried out, are given for 34 towns and 21 villages visited by the Sanitary and Deputy Sanitary Commissioners and Civil Surgeons. We shall have to wait for the results, but, in the meantime, one lesson taught by this inspection work is that, in the majority of cases, there is no systematic sanitary administration whereby the recommendations made can be carried out. What may be called the sanitary executive can scarcely be said to exist, and it may be suggested that any measures for introducing or extending local self-government among population groups in the Punjab should comprehend within their sphere the improvement of localities and dwellings of the people. This seems to be the practical result of the inspection reports.

31. In concluding our remarks on Mr. Bellew's Report for 1881, the following points appear to require notice.

The most important of them is the now proved relation of stagnant subsoil water, augmented by abnormal rainfall, to malarial fever. Progressive approach of subsoil water to the ground level consequent on canal irrigation, and possibly outlet obstructions due to embankments, without drainage to prevent back watering, may at any time, as has been shown by the Amritsar experience let loose a whole train of consequences ending in great public loss by illness, death, and injury to property. Nobody nowadays would venture to call in question the great public advantage of highways, railways, and canals, whether as means of transit or for increasing agricultural produce of a country. But must it be assumed, as a necessary consequence, that groups of population must undergo a process of decimation from time to time in order that the general public may profit by the works? Where great improvements lie along separate lines, there appears to be danger in overlooking the fact that they may exert injurious influences away from these lines and their objects altogether. What appears to be wanted is simply a grasp over new causes which may be called into existence by new works. No road or railway can run across an imperfectly drained or water-logged country without influencing all the conditions of organic life in its course, and no irrigation work which improves the produce of a region through which it passes but may cause a greater continual loss of life than would be the result of periodical famines. Year by year evidence of this law has been accumulating, and the Amritsar experience has completed the proof of its universal incidence. Does it therefore follow that roads, railways, and canals must be destroyed or left unmade? Certainly not; but what follows, beyond all possibility of denial, is that in hot climates no works of these classes should be undertaken without providing against fatal evils which may accompany their execution and follow it.

There is no mystery in the matter. Every scheme should be considered not only in the view of its professed objects, but in the light thrown by past experience on its possible effects on the public health.

In so far as regards existing works, means should be adopted for restoring all drainages obstructed by railway or canal works. Drainage should be provided for removal of all excess of irrigation water and water raised from wells should be used by preference for irrigation where the water level has been elevated too near the surface by infiltration from canals.

As regards general local sanitary defects, there is nothing new in the year's report. Towns and villages require better drainage, better water, and cleanliness extended from the public streets to the compounds, and houses, and more efficient executive authorities.

This may be done, as already suggested, by extending the principles of local self-government in the Punjab, and the local authorities should have powers granted them to perform the necessary works, and to find the means of execution.

Lastly, we desire to acknowledge the high value of the Sanitary Commissioner's Report of 1881, both in its practical aspect and as throwing additional light on the relation of climatic and local conditions to epidemic prevalence.

19th June 1883.

No. 6.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the NORTH-WEST PROVINCES and OUDH for 1881.

1. The following tabular abstract gives the aggregate results of registration in the North-West Provinces and Oudh for the census year 1881 :—

	Population, 1881.	Births.		Deaths.	
		Number.	Ratio per 1,000 living.	Number.	Ratio per 1,000 living.
Males	- 22,912,556	948,191	21·50	744,435	32·49
Females	- 21,195,813	881,282	18·84	658,038	31·04
Total	- 44,107,869	1,779,473	40·34	1,402,473	31·79

The birth-rate in this abstract is apparently too high, and the death-rate not high enough, but still there can be no doubt that registration of births and deaths is undergoing considerable improvement in these provinces.

It is perhaps too soon to make use of the element of age in discussing the death-rates, but, as the general registration has improved, we may venture to include these data in the following abstract. It will be seen that ages are only rough estimates.

Ages at Death.		Sexes.	Number of Deaths.	Ratio per 1,000 living.
Infants	-	Males -	243,911	406·74
		Females -	213,694	360·04
		Total -	457,605	383·50
1 to 15 years	-	Males -	159,621	19·62
		Females -	143,514	20·33
		Total -	303,135	19·90
14 to 45 years	-	Males -	144,252	13·31
		Females -	127,629	12·62
		Total -	271,881	12·90
Above 45 years	-	Males -	196,651	58·88
		Females -	173,201	50·42
		Total -	369,852	54·5

These registered facts must be taken as an instalment of what would be useful information could it be depended upon, but the vague estimates of age prevent their being used for purposes of comparison. As the facts stand they show that deaths under one year of age amount to 32·6 per cent. of the total deaths, and to 25·7 per cent. of the total births. Out of 1,779,473 infants born, the number which would survive the immediate perils of birth and infancy to take their places among the future population of the provinces would be 1,321,868 (that is if the facts were reliable).

2. The next abstract gives the deaths according to class.

Class.	Population.	Deaths Registered.	Deaths per 1,000 living.
Hindus and other classes -	38,137,318	1,220,007	31·98
Muhammadans -	5,922,886	181,859	30·70
Native Christians -	13,264	607	45·76

When compared with the high death-rate of Native Christians, the rates of the other classes appear to be too low.

3. Mortality varied greatly in different districts. It was highest in the Terai (47·33 per 1,000) and in Cawnpore district (41·45 per 1,000), and lowest in Kumaun (20·88 per 1,000) and in Dhera Dun (20·76 per 1,000). Many of the districts show death-rates apparently below the truth. This result is to some extent confirmed by municipal death-rates, which are probably more correctly registered than those of country districts, although, as the Sanitary Commissioner points out, if

municipal birth and death-rates were alike accurate, many of the municipal populations would be rapidly dying out. The highest recorded municipal death-rate in 1881 was that of Ajudhia, in Fyzabad district. It was no less than 115·26 per 1,000, while its five years' average rate had been 70·42 per 1,000. The lowest rate of the year was 16·31 per 1,000 at Muzaffarnagar, apparently under the truth, as the previous five years' average was 30·10 per 1,000. In a number of Municipal towns the death-rate is below the truth, and the figures vary so greatly, even in towns in the same districts, as to require some explanation of the causes of difference.

This result is no more than might have been expected, but, taken generally, the recent improvements in registration methods have led to more exact record of facts, and we must hope for further advance in the same direction.

4. Similar diversities occur in cantonment returns for 23, of which the average death-rate in 1881 was 25·43 per 1,000. But, taken individually, we find death-rates of 6·40, 7·15, and 7·63 at one end of the scale, and 36 per 1,000 and upwards at the other. There is hence plenty of room for improvement, although a good beginning has been made.

5. *Chief death causes in 1881.*—The following deaths were registered under the usual headings in 1881 :—

Diseases.	Deaths.	Ratio per 1,000 of Population.
Cholera - - - -	25,865	0·58
Small-pox - - - -	17,153	0·39
Fever - - - -	1,100,599	24·95
Bowel complaints - - - -	82,814	1·88
Injuries - - - -	21,060	0·48
All other causes - - - -	154,982	3·51
Total - - - -	1,402,473	31·79

The great death cause of the year was as usual "fever," the mortality from which was 25-fold the conjoined mortality from cholera and small-pox, and the deaths of which no account is given were not far short of four-fold the cholera and small-pox deaths. With reference to these deaths from "all other causes," it may be stated that in the Punjab Report for 1881 it is shown that a considerable proportion of them can be separately classed under the head of "respiratory diseases," and this heading affords important information regarding a whole class of causes from which the civil population suffers, and which are veiled under the present nomenclature.

6. *Cholera.*—The death-rates from epidemic cholera, since the North-West Provinces and Oudh were conjoined in the returns, have been as follows :—

	Death-rates per 1,000.
1878 - - - -	0·52
1879 - - - -	0·84
1880 - - - -	1·67
1881 - - - -	0·58

Last year was a year of low cholera mortality, and its 0·58 per 1,000 death-rate followed a five years' average of 0·95 per 1,000. But even this higher average contrasts favourably with the following yearly rates after registration was established :—

	Cholera Deaths per 1,000.
1865 - - - -	2·53
1866 - - - -	0·27
1867 - - - -	1·95
1868 - - - -	0·64
1869 - - - -	3·06

The facts are of the same kind as those observed in the Punjab, namely, that of late years cholera has apparently diminished in intensity and fatality as sanitary work has made progress in the North-West of India.

7. The following was the distribution of cholera in these provinces in 1881. Deaths from it were registered in all the 11 divisions into which the provinces are divided, showing a general diffusion of the disease. But two districts out of 49 in the divisions returned no cholera deaths. There are in the districts 1,107 circles of registration, out of which 431 only furnished deaths, showing that within the registration circles themselves the attacks were strictly local in character, a fact which is also proved by the proportion of villages which furnished the deaths. There are 117,630 of these population groups, and the total cholera mortality of the year was returned by 4,573 of them, or less than 4 per cent. of the number. Cholera in 1881 appears to have conformed to the usual law of diffusion, viz., that a low death-rate indicates a smaller number of attacked population groups and fewer deaths in each, while during severe epidemic outbreaks the proportion of attacked groups and also the number of deaths on an average in each group are raised.

8. The following were the monthly registered deaths in 1881 :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	46	July - - -	2,380
February - - -	96	August - - -	998
March - - -	924	September - - -	485
April - - -	7,935	October - - -	340
May - - -	7,462	November - - -	687
June - - -	4,184	December - - -	328

There are no data in the Report to show the relation between monthly rainfall and monthly cholera mortality. The death-rate itself varied considerably in different districts. In some of them the rates were '01 per 1,000. The highest rate of the year, 2·88 per 1,000, was returned from Basti district. As a general rule cholera was most prevalent and fatal in the south-east regions of these provinces, particularly in the triangular areas between the rivers Tapti and Ghogra, and between the Ghogra and Ganges above their points of junction. "In the eastern districts 7·0 per cent. of the "centres of population provided a record of cholera deaths, against 1·2 per cent. in the centres of "population of the 36 districts west of Allahabad."

9. The 'most interesting portion of the present report on cholera is that relating to the great twelfth years' fair of 1882 at Allahabad, which is worthy of notice on account of the light it throws on several important points in cholera history.

Allahabad district occupies a triangular area of country between the Ganges and Jumna and the city is situated near the point of junction of the two rivers. The population of Allahabad district in 1881 was 1,386,462, and of the city 87,644. In the same year there were 253 deaths from cholera in the district and 21 in the city, but we have not the returns for 1882.

Allahabad district has rarely suffered much from cholera, as will be seen from the following annual death-rates for a series of years given by the Sanitary Commissioner :—

Ratios per 1,000.

Years.	Ratios.	Years.	Ratios.
1870 - - -	0·1	1876 - - -	1·4
1871 - - -	0·1	1877 - - -	0·1
1872 - - -	2·6	1878 - - -	0·4
1873 - - -	0·6	1879 - - -	0·2
1874 - - -	—	1880 - - -	1·2
1875 - - -	0·9	1881 - - -	0·1

This abstract includes the cholera death-rates in Allahabad district preceding two great twelfth years' fairs, and it will be observed that all the higher rates took place in the years intervening between the great Melas. But it must also be borne in mind that, for reasons which it is not necessary to discuss, this district of the North-West Provinces is much less liable to severe epidemics than many others, so that it would not be safe to assume that what may be done in the way of sanitary care of pilgrims at Allahabad would be sufficient in more severely affected districts. In the same way the experience of Allahabad proves conclusively that something besides the presence of pilgrims is necessary to the outburst of an epidemic.

The next step in the inquiry is to trace the monthly prevalence of cholera in the district during 1881, which will bring the history down to 1882, when the Magh (January) fair was held. This was as follows :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	—	July - - -	3
February - - -	20	August - - -	6
March - - -	53	September - - -	—
April - - -	89	October - - -	1
May - - -	71	November - - -	2
June - - -	29	December - - -	—

These facts show a very limited cholera prevalence during the last six months of 1881, and an entire cessation of the disease during the month preceding the fair. The figures include deaths in the city, as well as in the rural parts of the district.

10. The fair was held on a triangular area of sandy ground between the Ganges and the Jumna, at the point where they join at an acute angle, about three miles and a half from the city of Allahabad and about a mile from the fort. The ground occupied by the fair appears to have been about half-a-square mile in area, from which the surface stretches to the point where the rivers unite, and this is the great bathing place; but close adjoining the site is an extensive sandy area, about three miles and a half in length and a mile broad, which appears to have been used as a common latrine, and is marked

on the map as an "area of impurity." The nearest point of this area is distant about a mile and a half from the city. A few common latrines were provided close to the fair site, together with hospital accommodation.

The Sanitary Commissioner states that "the fair site itself was noticed to be well kept as regards cleanliness. . . . A considerable number of sweepers were employed for its conservancy, and "they worked willingly for the removal and burial of all objectionable sweepings."

But the great area already mentioned could not be dealt with at the time. It must be obvious, however, that in future this evil must be remedied; of course such a state of things could not exist without infecting the air to some distance with noisome odours.

The fair days lasted from the 12th to the 22nd January 1882, but pilgrims began to arrive several days earlier, and the assemblage did not finally disperse until the 26th. This Mela is considered to be of special importance for purification from sin, and the facilities now afforded for travelling brought together no fewer than three millions of people. There was a continual succession of visitors, and it is considered that the average population during the fair period was at least a million. Part of this vast population had shelter under tents, part slept in the open air, but all who could find house accommodation did so. On inspection, it was found that crowds of pilgrims were lodged in every centre of population the site contained, including the city.

"The houses generally overcrowded, many of them quite full of people, lying at night time in "pretty close order, rooms, verandahs, outhouses, temporary shelter of mats, tree-shaded portions of "courtyards, all accommodating to the utmost their quota of people. . . . Surface cleanliness "neglected, the drainage ways choked with sweepings. . . . Attached private retiring places "generally in one corner of the courtyards, overflowing with impurities. . . . The water of the "wells, stirred up by ceaseless drawing, slightly discoloured and of unpleasant odour. This condition "of the water-supply so general that, during all the time of my stay near to the fair site," says the Sanitary Commissioner, "water for camp use had to be brought from the civil lines, a distance of "two miles." The bad water was used by thousands of persons, "not all without complaint, but "apparently in sheer despair of any better supply."

The month of January is usually a time of dormancy of cholera in this portion of the North-West Provinces, and it is not until April that the mortality usually augments in a marked degree, but cholera nevertheless exists, and shows itself more or less during the preceding months of the year. It may be, therefore, taken for granted that this great fair, with its three millions of visitors and its average population of a million, was held in a country and at a time when cholera was more or less present in some part of it to a degree which called for rigid preparation and continuous exercise of precautions necessary for protecting the public health. In the present case, the actual area occupied by pilgrims is considered to have been kept clean, but the same attention does not appear to have been bestowed on the vicinity, and on localities frequented by pilgrims.

The sanitary precautions were, in fact, very defective, and, to all appearance, the only circumstance which prevented a great outbreak of cholera was the absence of what may be called epidemic intensity.

There were, nevertheless, cases and groups of cases of cholera among the pilgrims, which the Sanitary Commissioner became informed of on inquiry immediately on his arrival on the ground. The general belief was that there was no cholera, and the fact was only established by the personal examinations of the Commissioner. The following is a brief digest of the facts discovered:—

For the first four days of the fair, the 12th to 15th January inclusive, a few cases of minor importance were treated at the dispensary. On the 15th diarrhoea was prevalent among the people. On the morning of the 16th five cases of cholera were received into hospital in the city—four in pilgrims resident in the city and one in a girl pilgrim resident near the city. On the 16th and 17th no cholera could be found, but diarrhoea was prevalent. On the night of the 17th a child among pilgrims from Bareilly died of cholera, and three other cases were found on the 18th in the same company. On the same day six or seven cases were found by the Sanitary Commissioner among fakirs lying on the ground. The 19th was the great bathing day; there was great excitement, and "fully a hundred" cholera cases were discovered. By the evening of the 19th cholera appeared on all portions of the fair site, cases were found dead and were buried on the spot. The people became alarmed and began to disperse. On the 20th the most severely affected areas were vacated, but cases of a virulent type were found on other parts of the site, and also on the 21st and 22nd (the latter another bathing day). On the 23rd and 24th the people dispersed and the fair came to an end, but the danger was by no means over. There were great crowds of people at the railway station trying to get away; during the 21st, 22nd, and 23rd, the crowd filled all the space between the station and the city, and every day cholera cases were carried from it to the hospital in the city. A considerable number died and were buried in deep trenches. The trains carried away about 25,000 people daily, "and there can be no manner of doubt that many pilgrims affected with cholera disease were carried "away in the trains, for at almost every station on the line between Allahabad and Cawnpore and "Allahabad and Jabalpur persons affected with cholera in its well-developed stage were taken out "of these pilgrims' trains and cholera disease declared its presence also among groups of pilgrims "travelling by road into Oudh to the east, Bundelkund to the west, and Benares to the south."

It was further reported, but not verified, by the Sanitary Commissioner, that wherever returning pilgrims congregated, cholera appeared among them, and then follows this important statement:— "But although the pilgrims showed this tendency to suffer from the complaint, it seemed unable to "establish itself anywhere among the people who had not been at the fair. Nowhere, so far as I "know, was the return of pilgrims to their homes followed by outbreak of disease amongst the "general population."

The whole history of this fair, and its consequences, could not, of course, be given in the official report for 1881, so that its relation to cholera history in 1882 must be waited for until next year's report is issued. But as the Sanitary Commissioner has given the cholera deaths for January and February 1882 for eight districts, situated in three divisions of the provinces, we may here insert them, together with the corresponding data for 1881 :—

District.	Cholera Deaths, 1881.		Cholera Deaths, 1882.		Date of First Death reported, 1882.
	January.	February.	January.	February.	
Allahabad - -	—	20	286	89	15th January.
Fatehpur - -	—	—	29	52	22nd "
Banda - -	—	6	180	164	10th "
Partabgarh - -	3	10	185	132	20th "
Sultanpur - -	10	—	103	388	4th "
Mirzapur - -	—	2	69	30	Unknown.
Benares - -	13	29	219	54	"
Jaunpur - -	1	—	101	64	"

In none of the districts in this abstract would the dates of attack in 1882, so far as they are known, correspond with the events of the fair, so as to establish a causative relation between the fair and the earlier cases in the districts; but the Sanitary Commissioner states that a much more minute statistical account was in preparation.

The deaths in all the districts were much greater in 1882 than in the preceding year, and these deaths might have mostly occurred among pilgrims. But, as already stated, we must wait for the whole year's cholera history.

From the facts as they stand it is not improbable that high cholera death-rates among returning pilgrims may have raised the general district death-rates where these deaths were registered; but whatever may have been their influence in this respect, there appears to be little doubt that the sanitary regulation of this great fair was defective in many important points.

Before another fair, the whole vicinity should be kept free of surface pollution, and stringent means adopted to prevent the visitors from fouling the ground. Latrines should be provided in proper places and in adequate numbers. Pure, wholesome water would have to be provided and laid on by pipes, and all overcrowding of Allahabad and the villages prevented. This would involve, as a requirement, that all visitors should provide themselves with suitable covering or shelter, and steps would have to be taken to insure the safety of pilgrims on their departure, and until they arrived at their homes. If pilgrimages on this gigantic scale are to be continued, the duty of protecting the public health should apparently fall on the local municipal authorities, and it would be only just that any expenses required for this object should be levied on the pilgrims.

11. In the month of April 1882, after the Allahabad pilgrims had dispersed, a fair was held at Hurdwar, about 450 miles north-west of Allahabad, which afforded contrasted experience worthy of notice. Hurdwar, as is well known, is a place of pilgrimage resorted to from all quarters. The great fairs are held in March and early in April, the latter month being the time when cholera revives in districts west of 80° east longitude, and the coincidence of revival of cholera, and the dispersion of pilgrims, has often led to the belief that the fair was the cause of an epidemic. In 1882 ample preparations were made for the sanitary protection of pilgrims. The magistrate, assistant magistrate, and police superintendent were encamped at the spot. The site was cleansed and kept clean under English inspectors. Latrines were provided in every place where throngs of people were expected. There was a large horse fair, and grooms and horse dealers were required to keep the surface clean, and to bury the sweepings immediately. A plentiful water-supply was available, and the bathing places were kept clean. General and detached hospitals were established, and means were taken for the immediate report of all diarrhoeal cases on the fair site or adjacent towns. The whole arrangements were supervised by the Sanitary Commissioner, who also saw every case of disease admitted to hospital. The sanitary arrangements appear to have been as complete as possible before the pilgrims arrived. There is no information available to show the amount of cholera in this region during 1882. But it was nearly exempt from the disease in November and December 1881. Under these conditions the Hurdwar fair of 1882 was held. The fair lasted ten days, between the 6th and 16th April, and 100,000 pilgrims were present on the chief bathing day. The Sanitary Commissioner estimates a daily average attendance of 60,000. More were expected and provided for, and "from the presence of only so manageable a number of persons, and the goodness of the arrangements, it resulted that a most satisfactory cleanliness was maintained everywhere."

The results to health are stated as follows:—"Cases of disease admitted to hospital were never numerous, generally of little importance, and only one death occurred. This happened in the case of a Punjabi man, suffering from obstruction of the bowels, said to have resulted from a meal of new grain." On the 9th April a case of choleraic disease, which recovered, took place in a woman pilgrim from Jammu. This was the only case which occurred at the fair. The Sanitary Commissioner states that he "stayed at the fair until the assemblage had quite dispersed," that he "inquired carefully concerning the welfare of the retiring pilgrims, and neither saw nor heard any mention of disease amongst them."

Nevertheless, the newspapers stated that cholera disease "was epidemic at this fair," a circumstance which shows the need of careful observation and record of facts at the time, such as was provided for

by Mr. Planck, both at Allahabad and Hurdwar. The history of this latter fair cannot be completely given until the history of cholera in the North-West Provinces and in the Punjab for 1882 has been reported; but there can be no doubt that sanitary precautions were taken with very different degrees of care, and so far as we can judge from the data available, with very different results in the two cases, as well as of the practical lessons for future management of all fairs which they convey.

12. *Small-pox*.—In 94 towns in the North-West Provinces and Oudh, having an aggregate population of 2,738,788, small-pox deaths, 1,067 in number, were returned from 66.

The country districts have a population of 41,369,081, and returned 16,086 small-pox deaths. The death-rates for both classes of population were precisely the same, namely, 0·39 per 1,000, not much more than a quarter of the preceding five years' average, which was 1·49 per 1,000. The monthly incidence of the disease for the whole population was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	1,566	July - - -	805
February - - -	1,950	August - - -	538
March - - -	2,840	September - - -	187
April - - -	4,636	October - - -	100
May - - -	3,090	November - - -	112
June - - -	1,319	December - - -	260

These figures are in accordance with the monthly law of small-pox prevalence in other districts of India, which cannot be better stated than in the words of the Sanitary Commissioner, who says, "throughout the province a total of 17,153 deaths from this cause were recorded, and of these, 15,401 were registered during the first six months of the year, chiefly in the months of the hot season, March, April, and May. This proof of unusual prevalence of small-pox in the months of hot seasons, and its decline as the rains are established has been a marked result of the registration since its commencement."

The law of annual prevalence of small-pox in the provinces is shown as follows for the last 12 years in death-rates per 10,000 of the population:—

Years.	Ratio per 10,000.	Years.	Ratio per 10,000.
1870 - - -	8·	1876 - - -	9·
1871 - - -	12·	1877 - - -	8·
1872 - - -	11·	1878 - - -	39·
1873 - - -	28·	1879 - - -	17·
1874 - - -	25·	1880 - - -	1·
1875 - - -	7·	1881 - - -	3·

A knowledge of facts of this class is necessary in estimating the effect of vaccination on small-pox mortality. No doubt the last two years show a great decrease of deaths, but we agree with the Sanitary Commissioner, that the deaths in 1882 and 1883 will have to be still accounted for. If the reduction continues, the table would afford reasonable evidence that small-pox was being influenced by vaccination. The total registered births in 1881 were 1,779,473, but the vaccinations were only 687,916 of all ages:—

13. The following was the topographical distribution of small-pox deaths in 1881:—

- (1.) Deaths were registered in all the districts.
- (2.) Out of 1,107 circles of registrations, 673 returned small-pox deaths.
- (3.) Out of 117,630 population centres (towns and villages), small-pox deaths were registered in 8,198. Many of these must have had single deaths, as the total deaths of the year were 17,153.

The year's epidemic hence covered a very wide area of the provinces, but a small number of population centres, only about 1 in 14, suffered, and among these the epidemic was of very low intensity, and showed little disposition to spread beyond the first cases attacked.

14. Vaccination has been actively carried on; calf lymph has been tried in one of the circles, with the following results, as stated by the Sanitary Commissioner:—"The success (in vaccinating calves) was complete, and a good supply of lymph was obtained from the resulting vesicles. With lymph thus obtained, a considerable number of children were vaccinated with most perfect result."

The following was the vaccination staff for the official year 1881-82:—

Superintendents of circles	-	-	-	-	3
Deputy Superintendents	-	-	-	-	7
Native " "	-	-	-	-	50
Vaccinators, 1st class	-	-	-	-	234
" 2nd class	-	-	-	-	377
Chaprasas, and other servants	-	-	-	-	63
Total staff	-	-	-	-	<u>734</u>

As already stated, the total vaccinations and revaccinations with successful results were 687,916. The total cost was 11,445L, or 2 annas and 8 pice (4d.) per case.

15. *Fevers*.—Under this head were, no doubt, included many cases with febrile conditions due to other diseases, but the Sanitary Commissioner considers that the great majority of deaths are of true malarial fevers.

The following monthly abstract of fever mortality shows anew the influence of climate on the monthly death ratios :—

Months.			Fever Deaths.	Months.			Fever Deaths.
January	-	-	75,154	July	-	-	58,047
February	-	-	72,534	August	-	-	60,590
March	-	-	76,431	September	-	-	83,310
April	-	-	90,176	October	-	-	153,173
May	-	-	84,341	November	-	-	154,378
June	-	-	62,305	December	-	-	180,160

The total fever deaths registered as such were 1,100,599, and of these nearly one half took place in the last four months of the year, showing, as the Sanitary Commissioner points out, that, as in all years, the chief fever mortality is registered in the months immediately succeeding the close of the rains, which are the months of lower and more variable temperatures also.

Fever deaths were returned from all the registration districts, and from all the 1,107 circles with only 16 exceptions, and from almost all villages, which number 117,630, in these provinces.

Ninety-four towns returned 70,418 deaths out of an aggregate population of 2,738,788. The country population, numbering 41,369,081, registered 1,030,181 fever deaths. The town death-rate was 25·71 per 1,000, and the country death-rate 24·90 per 1,000. The fever death-rate for the whole population was 24·95 per 1,000, against a previous five years' average of 21·85 per 1,000. It cannot be said that the comparison is a favourable one for the year 1881.

16. One of the most important predisposing causes of these Indian malarial fevers is a lowered health standard from defective nourishment, and that this factor may have exercised a certain influence on fever mortality may be shown by comparing the prices of the chief articles of food for two years, as follows :—

					Seers sold for a Rupee in December.	
					1876.	1881.
Wheat	-	-	-	-	23	19
Barley	-	-	-	-	29	28
Juar	-	-	-	-	34	29
Gram	-	-	-	-	31	24

The average prices during the intervening years were for all these grains :—

					Seers per Rupee.	
					June.	December.
1876	-	-	-	-	29	29
1877	-	-	-	-	27	14
1878	-	-	-	-	14	18
1879	-	-	-	-	16	17
1880	-	-	-	-	21	23
1881	-	-	-	-	21	25

The year 1876 was a plentiful year, and the figures show a gradual rise in prices in the scarcity years, which have fallen since then, without having reached the level of 1876. As regards the high price of wheat, the Sanitary Commissioner states that "this is not a matter of very great importance, so far as the welfare of the people generally is concerned, for wheat never has been a staple of diet for the multitude in any recent years, but has partaken essentially of the character of a rent-paying crop." Facilities of transport have also raised the price and tended to equalize it. Still, prices of staple food articles have been raised of late years, and this fact must be taken into account in discussing the fever question.

17. Another cause, affecting the country generally, is rainfall, the amount of which for the year 1881 is given for the 49 districts of these provinces. In 17 districts the rainfall exceeded the average, and in the remainder it was below the average, but in none of the cases of excess does there appear to have been a causative relation between rain and fever mortality. This much it is necessary to state, but the data are too imperfect to enable any reliable comparison between fever deaths and

meteorological elements to be drawn. There are, however, data of a certain kind yielded by the irrigated districts, which may be given as follows:—

Irrigated Districts.	Fever Mortality per 1,000.		Rainfall above or below Average.
	Five Years' Average.	1881.	
			Inches.
Meerut - - -	34·28	33·51	— 2·
Muzaffarnagar - -	29·98	29·26	— 6·4
Bulandshahr - -	40·18	29·19	— 0·3
Furakabad - - -	27·38	27·24	+ 5·2
Saharanpur - - -	22·20	27·13	— 6·4
Etawah - - - -	25·31	26·68	+ 7·4
Mainpuri - - - -	29·72	26·41	+ 13·1
Cawnpore - - - -	28·03	26·29	+ 9·9
Aligarh - - - -	39·17	23·42	— 2·9
Etah - - - - -	29·95	25·46	+ 11·
Muttra - - - - -	38·60	22·41	+ 3·2
Agra - - - - -	34·83	22·24	+ 11·5

The last four irrigated districts in this abstract show a decided falling-off in fever mortality in 1881, although in only one of them, Aligarh, was the rainfall below the average. In the other three the rainfall was considerably above the average, and in these three, at least, we should have expected a larger percentage of fever deaths. In all four there was a large reduction of fever deaths, a fact which is accounted for by the Sanitary Commissioner as follows. He says, "This is satisfactory, and may result from the action of drainage works, and a more careful distribution of water." If this view be accepted, it would follow that these drainage works had not only greatly reduced the liability to fever in the districts, but had removed the excess of rain, and consequently the additional mortality which otherwise might have been due to it.

The other irrigated districts, with the exception of Meerut, show a considerable similarity in fever death-rates for 1881, and these have not, apparently, been influenced either by excess or reduction of rainfall. It would be interesting to know whether drainage works have been executed in Bulandshahr district, for the reduction of mortality has been more remarkable there than in any other district.

These facts, as they stand, show that drainage of irrigated districts reduces fever mortality. On the general question of the relation of fever mortality to irrigation works, there is nothing in the present year's report to modify the opinions we expressed in our memorandum on the report for 1880, which have, moreover, been strikingly confirmed by experience since obtained in the Punjab.

It may be now considered as proved that, if water for irrigation be introduced into a district, and supplied in excess of requirements of agriculture to such an extent as to waterlog the subsoil and raise the subsoil water level, there will be an increase of mortality from malarial fever; and further that, under certain atmospheric conditions, including large rainfall, fever deaths may attain the dimensions of a great pestilence.

18. Taken by "districts," the fever death rates lay between 8·23 per 1,000 in Lalitpur in Jhansi division, the lowest rate, and 41·41 per 1,000, the highest, which was registered in the Terai, a rate which was 10 per 1,000 above the preceding five years' average, although the rainfall was 44·5 inches, against the average of 48·1 inches.

In this case the actual rainfall of the year, together with other undescribed meteorological elements and the usual subsoil conditions, appear to have co-operated in raising the fever-rate. But if the fever mortality be taken by circles, as shown in the fever map, it will be seen that the highest death-rates were purely local. As already stated, fever deaths were returned from 1,091 circles of registration out of 1,107, but to only 26 of these circles are excessive death-rates assigned on the map, and they are scattered all over the provinces close to the great rivers, or to the irrigation works, except the Terai circles. The highest circle death-rate is that of Ballia, 69·5 per 1,000, which is one of the four circles occupying the triangle at the junction of the Ganges and Ghogra.

The other three circles have rates as follows—41·7, 40·7, and 30·9. It may be remarked that the circle Bairia, where the lowest rate took place, has the Ganges on one side and the Ghogra on the other. In the canal irrigated districts the highest rates may be taken generally at between 4 and 5½ per cent., very high rates no doubt, but occurring among small populations and in only a few groups.

19. Of towns, the highest local fever-rate of the year was returned from Ajudhia, in Fyzabad district. This town, with a population of 11,643, had a death-rate from all causes of 115·26 per 1,000, of which no less than 81·68 per 1,000 was due to fevers. There must be something radically defective in this place, for its death-rate, on a five years' average, has exceeded 7 per cent. from all causes. Little is said in the present report on merely local conditions which have been often discussed by the Sanitary Commissioner in previous years. It may, however, be taken for granted that these operated as usual in the year 1881, and the fever history of the year appears to show that, while there was an average series of death-rates over the provinces, the rates were augmented considerably above this average in certain defined areas, where besides purely local causes, the influence of subsoil damp from rivers and canals came into operation. The practical conclusion from the year's experience is the same as that of former years, namely, that local disease causes in villages and towns should be

actively removed, that local drainage should be rendered more efficient, especially in canal irrigated districts, and that irrigation water should cease to be applied in excess of the requirements of vegetation.

20. *Bowel Complaints*.—Under this head the following monthly deaths were registered in 1881 :—

Months.	Deaths.	Months.	Deaths.
January - - -	6,819	July - - -	6,261
February - - -	5,383	August - - -	7,227
March - - -	5,658	September - - -	7,682
April - - -	7,581	October - - -	8,212
May - - -	7,556	November - - -	8,000
June - - -	6,192	December - - -	6,748

The death-rate for the year from these diseases was 1·88 per 1,000, while the previous five years' average was 2·26 per 1,000. Deaths from them were returned from all the 49 registration districts, and from 1,029 registration circles out of 1,107, but no return was made of the villages registering deaths.

A list of eight districts is given in which bowel complaint deaths were unusually numerous. These are considered by the Sanitary Commissioner to be chiefly dysentery, "probably due to malarial prevalence as much as fever itself." In one district, Cawnpore, the deaths for the last five years have given the following rates per 1,000 from bowel complaints and fever :—

Years.	Bowel Complaints.	Fever.
1877 - - -	1·0	19·0
1878 - - -	1·4	20·6
1879 - - -	1·1	46·8
1880 - - -	6·2	29·0
1881 - - -	6·3	26·2

These increased rates have, it appears, accompanied extension of irrigation works.

If this connection were established, the fact would show that there is a relation of dysenteries to subsoil water level.

21. *Injuries*.—Under this head were registered deaths from the following causes :—

Suicides - - -	2,233
Wounds or accidents - - -	13,017
Snake-bites and wild beasts - - -	5,810
Total - - -	21,060

Deaths from these causes, though below the five years' average, are still high. Destruction of wild animals might be more efficiently followed up with advantage.

22. *Sanitary Works (Civil)*.—Sanitary work has made progress during the year, chiefly in municipalities, 65 of which are named as having executed improvements of some kind. None of these are on any great scale, and have been mainly confined to surface drainage, roads paving, better conservancy, cleansing wells, and other works of the same class. A few cases of these may be introduced by way of illustration.

Almora has had its whole site drained, and the town has a plentiful supply of good water. The public latrine arrangements were extended. The death-rate of this municipality was 17·45 per 1,000 in 1881.

Terai.—Drainage lines have been extended and improved.

Bulandshahr.—"A work of considerable sanitary importance" for preventing flooding has been carried out, and town improvements have been in progress. "Mean looking houses are being replaced by new and handsome buildings, to the quite altered aspect of the town generally. And it is only just to say that Bulandshahr, in its renewed appearance, may rightly claim the first place in the race of town improvement which has characterised the municipal government of recent years." It is right to add that these results are ascribed to "the wisdom and conciliatory character of Mr. Growse's management."

Bulandshahr town has a population of 17,863: its death-rate in 1881 was 24·24 per 1,000, and its previous five years' average death-rate was 43·27 per 1,000.

At *Cawnpore* city "a total length of 13,509 running feet of the new drainage system was constructed." Two unwholesome excavations in the middle of the city were filled up and levelled. It is evident, however, that the real disease causes in this city of 120,161 inhabitants have not yet been reached, as is shown by the fact that its very high average death-rate for five years past, namely, 42·35 per 1,000, was raised in 1881 to 50·93 per 1,000, of which no less than 33·96 per 1,000 was due to fevers.

Benares has forbidden keeping of pigs within the city limits, and tanneries have been removed, but as regards permanent works the Sanitary Commissioner tells us that "the long proposed water-supply and drainage scheme has made no progress, it still remains under the earnest consideration

" of the municipality " but disease and death levy their municipal tax notwithstanding. Benares contains 193,035 people and its five year's average death-rate of 26·67 per 1,000 was raised in 1881 to 45·39 per 1,000. In the course of the year, no fewer than 5,270 of its people died of fever.

At Lucknow, 30,838 feet of stone and masonry built drains were constructed, some new wells were sunk, 17 ditches had been filled up and 36 others were in progress of filling, 5 latrines were built, and an artesian well sanctioned. The death-rate of this large city of 239,773 inhabitants had fallen from a five years' average of 46·01 per 1,000 to 40·63 per 1,000 in 1881. Its fever death-rate was 25·91 per 1,000. High as the rate is, we should consider it a good sign if the rate of 1881 were the result of good work done.

In the other smaller municipal towns, the works have been of the nature already described, simple, inexpensive, and no doubt advantageous to the public health.

Works of a more important class still under consideration are the water-supply and drainage scheme for Benares, already mentioned, plans and estimates for which had been in existence for the preceding two years; the drainage scheme at Azamgarh; water-supply for Agra and Lucknow, and drainage schemes for Bareilly and Gorakhpur.

23. *Villages.*—We are glad to learn from the present Report that, " during the year 1881, a very considerable progress has been made towards the realization of a better sanitary state of the larger villages in the province," namely, places with from 1,000 to 4,000 inhabitants, in which gradual increase of population had not been met by corresponding improvements in village sites, conservancy, water-supply, &c.

A year or two ago steps were taken by certain local officers to remedy the observed defects with considerable success, and the Government issued a Circular, No. 158 of 1880, in which the action that had been taken in Banda district was set forth for imitation. It was found that in Baraich district there were 30 of these large villages, and the following rules were issued, viz., that all refuse must be removed to a distance at least 200 yards from the villages, and no nuisance to be permitted nearer; all wells to have their mouths raised and the surrounding ground to be kept clean; and the floors of cattle sheds to be raised above ground level. " Tahsildars and thanadars were required to submit weekly statements to the Deputy Commissioner showing the degree of obedience locally accorded to the rules proclaimed."

These rules were followed by village officers, " and in no instance was any spirit of opposition to the rules evinced. There were cases of neglect which were met by special letter or by a small fine." The following was the result of these measures :—

" After 12 months' experience of the working of the rules Mr. Ferrar, the Deputy Commissioner, records the belief that the general public opinion favours the action of the rules, from which an improved sanitary condition has undoubtedly resulted in the villages concerned." These larger improved villages escaped cholera during the year at a time when it " was claiming victims in the neighbouring smaller villages." In consequence of this, the rules were to be extended to 80 more important villages. Similar rules were proclaimed in 14 of the largest villages in Jalaun in May 1881, and by the end of the year 65 villages were brought under their operation. The pargana officers were directed to inspect these villages, which they did carefully and completely, and not the slightest opposition was made to the rules. Boundary pillars were set up at 200 yards from the villages to mark the area within which no impurities were to be deposited. These are considered by the Deputy Commissioner of importance as giving the people a visible proof that obedience to the rules is expected. Already seven villages had been so far improved that letters of approval had been sent to the lambardars.

24. Connected with this same subject is a summary of reports of Deputy Sanitary Commissioners, most of which is devoted to vaccination work, but there are nevertheless matters contained in the summary to which pointed attention should be called. Some years ago the hill station of Chakrata in the Himalayas was selected for troops after careful examination and comparison with other sites, and when the water-supply came to be provided, Dr. Pringle states in his report that the method adopted was only suited to hill village irrigation purposes. He " condemns the water-supply now in use there by the troops as liable to contain surface impurities, which will eventually produce general sickness," and advises conducting a supply from a source in the Deoland mountain by iron pipes at a cost of Rs. 20,000. He advises a similar plan for improving the water-supply of Mussoorie. We have several times had occasion to notice the quite original methods of providing bad water for domestic use in India, and here is another example. At Agra the wells are brackish, and what the city requires is simply a proper water-supply. But lately the notable expedient has been adopted " of allowing the rainfall to drain into them," the assumption of course being that the rain will leave all impurities it may have carried with it before it falls into the wells. Dr. Taylor considers that the foul and putrid state of the water provided for cattle is the chief cause of cattle diseases, as no doubt it is in India as everywhere else.

The Deputy Sanitary Commissioner has made recommendations as to the cleanliness of villages and protection of wells, which we hope will receive attention on the part of the authorities. Another Deputy Sanitary Commissioner, Dr. Richardson, visited and reported on the sanitary state of 222 towns and villages during the year. He gives some interesting information about the hill cholera which is worthy of notice. He says, the filthy state of many of the hill villages is " brutal." Pilgrims come and go through them, and every spot of ground is fouled by them, so as to taint the air to a distance.

In May 1881 an outbreak of cholera took place in Gharwul; the disease appeared chiefly on the pilgrim routes to Kedarnath and Budrinath temples. The former is an old epidemic centre. In the present case " very few of the wayworn ill-fed pilgrims suffered from the disease." The chief victims

were the foul living villagers. Cholera this year attacked villages formerly the seat of the hill plague, and people and cattle still inhabit the same houses. In one village the first attack was stated to have taken place in a pilgrim.

The only wonder is, that plague and cholera are not always present. Rules against these foul habits have been issued, but "it is one thing to issue orders in the hills, and another to see that they are attended to."

25. Under the head of *General Remarks*, Mr. Planck resumes the year's work briefly. The general tone is hopeful. Much good work is being done, but there is a tendency to relaxation of effort, showing the extreme importance of constant supervision. To this end the Deputy Sanitary Commissioners have been placed in communication with local authorities, and provided with heads of a report to be filled up after each inspection, and handed to the local executive. We must hope that the improvements in local self-government which are to be introduced may lead to enlisting the services of gentlemen who take an interest in public improvements, and in forwarding improvements in public health.

26. In conclusion, it can scarcely be said that there is much new in the present year's report. This, indeed, could not be looked for. The sanitary state of the provinces is now well known. Everywhere there exist the usual local disease causes incident to past town and village life, the tendency of which has been to increase, from want of local knowledge and effort to remove them: and besides these, in certain areas, there have been great and useful irrigation works carried out, but in the absence of drainage, and regulation of irrigation water-supply. This important matter will be dealt with by the Government; but all other measures such as local cleansing, draining, improvement of water-supply, house and compound improvements, paving, levelling of surfaces and filling up or draining useless water holes, tree planting, and the like, will fall on the local authorities.

We are glad to learn from the Government orders that approval has been given to the proposed reporting by Deputy Sanitary Commissioners of all local defects; but they should also report to their chief how their recommendations have been carried out, and we join heartily in the hope expressed by the Government that "the municipal and district boards, as they are hereafter to be constituted, may be expected to take an active and intelligent interest in sanitary reforms, and any suggestions made will doubtless be readily accepted, and acted upon, so far as may be consistent with local conditions and financial considerations."

Mr. Planck, by many years of labour, has brought the sanitary knowledge of these provinces into such a condition, that what is most wanted now is action in dealing with local disease causes, and we must look to the new municipal institutions for this. In the meantime we cordially join with the Government in their acknowledgment of Mr. Planck's work, and its value to the public service.

11th June 1883.

No.7.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for the CENTRAL PROVINCES for 1881.

1. Since the Report on the sanitary condition of these provinces for 1880 was sent in, Deputy Surgeon-General Hutchinson, who was in the first year of his service as Sanitary Commissioner, and who drew up that Report, has been replaced under the new arrangements by Deputy Surgeon-General Dr. Simpson, who states that he was "wholly unacquainted with these provinces" when he entered on duty on the 3rd April 1881, and that his predecessor had left only one section of the present Report, on "the chief diseases," completed. It is necessary in alluding to changes of this kind to state that they cannot add to the efficiency of the sanitary service anywhere, and that it would obviously be advisable, in appointments combining the headship of the sanitary and medical services in the same officer, to do the best possible, with a due regard to the interests of both services, to enable the Sanitary Commissioner not only to acquire knowledge of the multitude of public health details in his districts, but to turn his experience, when once obtained, to the advantage of the public service generally.

2. The present Report begins with Section V. of the arrangement, that, namely, on the vital statistics of the general population; but in discussing the data certain reservations have to be made; because the population element used in the Report is not that of the census of 1881, which was 11,504,149, neither is it the population of the previous census of 1872, which was 9,251,229, because under both enumerations the census included areas not under registration.

The numbers in the present Report are those only which were within the registration areas of 1872, namely, 7,409,865, but, as the total population of the provinces had increased by 25 per cent. in the decade, there must have been a corresponding increase within the areas of registration, and a corresponding decrease in the ratios of births and deaths. We shall, however, adopt the numbers in the Report, in the hope that the necessary corrections may be introduced at an early period. The ratios obtained from them can in the meantime, be used, not as absolute facts, but for purposes of comparison.

3. The population of these registration areas was, then, 7,409,865 in 1872. In the same areas there were registered 362,744 births in 1881, giving a ratio of 48.94 per 1,000, probably 25 per cent. too high; were it otherwise, certain of the districts would have birth-rates of between five and six per cent.

The deaths registered in 1881 were 241,647 in number, equal to a death-rate of 32.59 per 1,000 on the assumed population. It seems scarcely necessary to discuss the question further, but the actual numbers of births and deaths registered would appear to point to improving registration, and what is now wanted is to work out the true population of these registration areas and towns on the census of 1881, and to use this in calculating the ratios. The Sanitary Commissioner himself gives an excellent example of the need of these corrections by citing the case of Murwara town, which, in 1872, had a population of 2,885, on which the death-rate in 1881 amounted to the enormous figure of 112.30 per 1,000. This result led to special inquiry, and it was found that in the decade the population had increased to 8,612, making the true death-rate 37.62 per 1,000.

4. *Chief death-causes in 1881.*—The following deaths were entered under the customary headings in 1881 :—

Diseases.	Deaths.
Cholera - - - -	9,140
Small-pox - - - -	1,816
Fevers - - - -	143,933
Bowel complaints - - - -	22,133
Injuries - - - -	3,957
All other causes - - - -	60,488
Total - - - -	241,467

We shall discuss each of these death causes, briefly beginning with cholera.

5. This disease was prevalent in an epidemic form along the sea coast and river deltas skirting the eastern boundary of the Central Provinces in January 1881, and in the same month it appeared in Bargarh registration circle, in Sambalpur district, about 150 miles from Cuttack, and the Mahanadi delta. Before the disease broke out at Bargarh it attacked one or two boatmen at Binka on the Mahanadi river, but Bargarh is the first circle which returned cholera deaths.

Between February and April there were 126 deaths in Sambalpur district, when the epidemic disappeared, but in August following there was a solitary death in the district. All the deaths took place in 20 villages out of 886 in the district, showing a low intensity of the epidemic, and no great diffusion of it in this eastern boundary district. In the region coterminous with the endemic cholera area of Bengal there was comparatively little cholera, and the epidemic covered the whole eastern regions of the provinces lightly, but it assumed the dimensions of a true epidemic in the western and north-western districts. There were, however, fatal cases in every district of the provinces, 20 in number. Out of 168 registration circles 106 recorded cholera deaths, both facts showing a very general diffusion of the epidemic, but, as usually happens, the losses of life were strictly local, for out of 27,247 population groups, including 72 towns, all the deaths were registered in 1,132 groups, of which 36 were towns. It follows that 50 per cent. of the towns yielded cholera deaths, 938 in number out of an assumed population of 483,582, while only 4 per cent. of the villages were attacked out of an assumed population of 6,926,283. On the registration district census of 1872 the cholera death-rates of these provinces in 1881 would have been as follows :—

	Ratios per 1,000.
Towns - - - -	1.94
Villages - - - -	1.15

No doubt in both cases considerably above the true ratios.

6. The following was the monthly distribution of cholera mortality in 1881 :—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	12	July - - -	958
February - - -	83	August - - -	1,961
March - - -	152	September - - -	1,969
April - - -	494	October - - -	813
May - - -	1,086	November - - -	90
June - - -	1,519	December - - -	3

In January and February there were 95 deaths registered in six registration circles in Sambalpur, Raipur, and Bilaspur districts, nearly all in villages. The only town deaths registered were five in Dhametri and one in Bilaspur; the other eight towns escaped the disease. As shown on the map, cholera over all the extensive eastern portions of the Central Provinces was more sporadic than epidemic in its distribution, but it assumed a distinctly epidemic character in the north-western districts, again fading away in the west as an endemic. Similar distributions of cholera have appeared in former years.

A number of reports of Civil Surgeons as to the mode of origin and extension of cholera are given by the Sanitary Commissioner. Some attribute the disease to pilgrims, others to the usual law of epidemic progress. The pilgrim data are not given with sufficient minuteness to enable us to judge whether the opinions founded on them can be accepted. Many years ago we called attention to similar defects in these inquiries, and nevertheless the Government state, in their letter prefixed to the present Report, that "the opinions of medical officers as to the mode of propagation of the disease" cannot be said to be generally of much value. They seldom seem to be founded on any careful "examination of facts."

A few "really tried to weigh the evidence supplied by the facts of the history of the disease in their districts, but the majority seem to have been content with vague and uncertain generalization." It seems to be unnecessary to pursue this subject further. As the evidence stands, cholera appears to have invaded the provinces from the east, but the true epidemic covered not the eastern, but the western regions of these provinces, and there it evidenced its usual erratic character, coming and going, active at one time, quiescent at another, following no special line or order of march, and disappearing without evident cause. Its severity displayed the same erratic character; in one group of villages there might be few deaths, while in others close at hand there was great loss of life. It would leave a village or group in its course and attack others out of it, returning again to take its victims from localities it had previously passed over.

These characteristics of cholera in these provinces are well brought out by the reports of Civil Surgeons. They cannot as yet be made amenable to any law of causation or movement, and must at present be accepted simply as facts.

A similar time irregularity is shown in the following abstract of death ratios from cholera for the last 13 years. The ratios are given as deaths per 100,000 to avoid fractions:—

Years.				Deaths.			
1869	-	-	-	1,050	1876	-	-
1870	-	-	-	—	1877	-	-
1871	-	-	-	—	1878	-	-
1872	-	-	-	21	1879	-	-
1873	-	-	-	4	1880	-	-
1874	-	-	-	—	1881	-	-
1875	-	-	-	198			

We have no means of accounting for these anomalies. The endemic sea-coast and river delta areas adjoining the eastern boundaries of the provinces have been the same year after year. Juggernath pilgrimages have been carried out as usual, from which pilgrims have gone and returned across the provinces, and yet for entire years there has been no cholera, while in cholera years the death-rates have varied between 4 and 1,050 per 100,000 of the population. We are thus brought back to the influence of local conditions and personal habits among the people *when cholera was present in the country*, on the amount of loss of life.

7. We referred to this important point in sanitary inquiries in our memorandum on the Sanitary Commissioner's Report for 1879, and suggested that, while making sanitary inspections of localities, an endeavour should be made to connect the disease history with sanitary conditions. This to a certain extent has been done in the report under review, but it may be well to introduce a caution in the manner of using the observed facts, because there appears to have been an impression that insanitary conditions were considered to be directly causative of cholera. This is not so; the facts of every epidemic tend to show the contrary. In the present Report the Sanitary Commissioner states the case as follows: "Enough has been said to prove that cholera does not confine its ravages to the dwellers in filthy villages, it would be scarcely possible when this disease is prevailing in an epidemic form that this should be so, for this active poison must declare its potency upon whatever locality it falls. But there seems to be sufficient evidence to prove that were the sanitary condition in the Central Provinces universally good the barrier placed to the progress of cholera would be so great as to check it, if not entirely, in great measure." The only difficulty in accepting this view in its totality is the absence of definition as to what are meant by "clean villages," because no village, whatever its outward aspect may be, can be considered clean from the side of public health, in which the compounds or houses are foul and the water-supply derived from foul ground near cattle sheds, dung-heaps, or cesspits. But, on the other hand, it has long been admitted that an epidemic may be so intense in its action as to destroy all people on whom it falls. This occurrence, however, is out of the range of experience, but all are agreed as to the predisposing influence of certain local and personal conditions when cholera is present, and it is with these, which are matters of experience, that we have to deal. Our suggestion already referred to was intended to bring out any facts showing the results of local sanitary work on the death-rates, bearing in mind that such apparent results should not be confounded with low mortality due to local mildness of the epidemic.

8. As a contribution to this inquiry, the Sanitary Commissioner has given the names of a number of cities and Sadhr towns where sanitary improvements have been carried out. In several of these there were no cholera deaths, and the others suffered comparatively little loss. We have placed these towns in the following table, and, in order to eliminate the effect of low cholera intensity in their vicinity, we have introduced the cholera mortality in the districts within which the towns are situated. The ratios are in deaths per 100,000, to save fractions.

Towns.			District.			Towns.			District.		
Sambalpur	-	-	41	None		Wardah	-	-	249	93	
Bilaspur	-	-	41	"		Damoh	-	-	110	159	
Mandla	-	-	30	"		Jubbulpore	-	-	521	109	
Saugor	-	-	33	"		Nagpur	-	-	254	71	
Hoshangabad	-	-	12	"		Narsinghpur	-	-	233	161	
Khandwa	-	-	12	7		Chindwara	-	-	86	33	
Betul	-	-	1	None		Chanda	-	-	57	12	
Seonie	-	-	163	"		Bhandara	-	-	183	35	

Taken generally, the facts show losses from cholera in towns far below the intensity due to the districts, and as all of them have been undergoing improvements more or less, the results augur favourably for the future, that is, provided the work is not only maintained but extended, because it is easy to see that, with a more intense epidemic, there might have been much more loss of life in these towns than actually occurred. It is a remarkable fact that, although 36 towns out of 72 in the provinces escaped cholera altogether, every district in which the exempted towns are situated suffered from cholera. Moreover, with the single exception of Kamptee, a town of 48,831 people, which yielded 116 cholera deaths, all the towns of largest population comparatively escaped. The most populous town in the provinces, Nagpur, contains 84,441 inhabitants, and yielded only 60 cholera deaths. Jubbulpore, with a population of 43,223, connected by roads and railroads with cholera infected regions, had only 47 deaths. Saugor district, with a population of 455,845, yielded 150 cholera deaths, while Saugor town, with 31,119 inhabitants, and Saugor cantonment, with 14,536, escaped the disease. These statistical facts appear to justify an opinion that sanitary work, such as it was, in the towns and under the prevailing epidemic conditions, had been effective in saving life, and the evidence of this, which they afford is more satisfactory than the opinion of such of the Civil Surgeons as have reported on the subject. It appears that there was some want of distinctness in the instructions under which they acted, and hence their reports are not detailed enough, but this will, no doubt, be rectified in future.

We may repeat here what has been often urged in different memoranda, that no adequate idea can be formed of sanitary condition, in reference to epidemic susceptibility, from a mere surface inspection of towns and villages, for it is already known that the most potent disease causes are those inside house compounds, where keeping of cattle, filth cesspits, and wells dug in foul subsoils are far more active predisposing causes of disease than filth in public streets or undrained surfaces. The new local authorities to be entrusted with care of public health in these provinces will have to deal with disease causes of this class as well as with the usual outside work.

9. *Small-pox*.—There is little information in Civil Surgeons' reports on this epidemic disease, but there are some facts revealed by statistics which are of importance.

The Sanitary Commissioner has given a table showing the annual death-rates from small-pox in each of the districts for 13 years, and the following annual death ratios for the province will show the law of prevalence.

Years.	Small-pox Deaths per 1,000.	Years.	Small-pox Deaths per 1,000.
1869 - - -	3.40	1876 - - -	0.51
1870 - - -	0.80	1877 - - -	0.37
1871 - - -	0.20	1878 - - -	2.18
1872 - - -	0.57	1879 - - -	3.44
1873 - - -	1.37	1880 - - -	0.69
1874 - - -	2.38	1881 - - -	0.24
1875 - - -	2.37		

These ratios show distinctly the epidemic nature of small-pox, while they show that this disease is always prevalent in the provinces, which, as we have already seen, is not the case with cholera; it is usually more generally diffused than cholera. In 1881 small-pox deaths were returned from all the 20 districts and from 112 registration circles out of 163, but the outbreaks appear to have nevertheless been strictly local, as all the year's small-pox deaths, 1,816 in number, were returned from 879 villages out of 27,247 in the provinces, showing that by far the greater proportion must have had no more than a single death.

The following abstract shows the monthly mortality in 1881:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	65	July - - -	218
February - - -	71	August - - -	227
March - - -	153	September - - -	84
April - - -	252	October - - -	51
May - - -	275	November - - -	90
June - - -	210	December - - -	120

As usual, the dry hot months have afforded the highest death-rates. Deaths arranged according to age gave the following proportions in 1881:—

—	Deaths.	Ratio per cent.
Under 1 year - - -	643	35.4
1 to 12 - - -	809	44.5
Above 12 - - -	364	20.0

During the past five years, there have been 51,411 small-pox deaths and 1,507,238 vaccinations, or in round numbers, one death for every 30 vaccinations. The births registered in 1881 were 362,744,

while the average number vaccinated would be about 301,448. There appears to have been a noticeable relation in some of the districts between a high vaccination-rate and a low death-rate from small-pox.

10. *Fevers*.—The conjoined death-rate from cholera and small-pox, 10,956 deaths is a small matter when contrasted with fever deaths, 143,933 in number. The approximate fever death-rate was 19·57 per 1,000 for the districts, and 17·30 for the towns—a difference in favour of the latter of 2·27 per 1,000, which, we must hope, marks the influence of sanitary work in the towns. The death-rate for the whole population, town and country, was 19·42 per 1,000 in 1881, against a previous five years' average rate of 20·84 per 1,000.

11. The following abstract gives the monthly fever deaths in 1881 :—

Months.			Fever Deaths.	Month.			Fever Deaths.
January	-	-	9,959	July	-	-	9,557
February	-	-	9,308	August	-	-	12,996
March	-	-	10,446	September	-	-	15,238
April	-	-	10,965	October	-	-	17,558
May	-	-	12,018	November	-	-	14,970
June	-	-	8,721	December	-	-	12,305

The months of June and July are usually the months of lowest fever mortality of the year, although the actual number of deaths in these months appears to bear a certain relation to the year's fever deaths. We have no means of collating the monthly mortality with rainfall, but the year's rain, which amounted to 54·32 inches, was above the average of the preceding five years. A greater influence, however, is exerted on the public health by rain distribution than by the actual amount which falls in the year, and probably the explanation given by the Sanitary Commissioner is the correct one. It is as follows :—" July is a month when the monsoon has commenced, and there is an equable temperature and freedom from those baneful influences which are developed later on in the year, after a long continuance of rain and an advance in the season have generated the conditions favourable for the development and action of malaria."

Although this view may be accepted, still, as we have often pointed out, the reporter should have the means placed at his disposal of comparing monthly meteorological elements with fever prevalence. It would be a step in arriving towards scientific accuracy in these important discussions.

12. The distribution of fever mortality in 1881 presented some points of interest, which may be noticed. Fever deaths were returned from all the registration circles, 168 in number, showing the very general prevalence of this disease. There are 27,247 population groups in the provinces, of which 21,497 returned fever deaths; but there are some unexplained differences in the district and town fever death-rates which appear to be related to local topographical conditions, in connection with climatic elements or to sanitary work. For example, Sambalpur district had a fever death-rate in 1881 of 8·58 per 1,000, and its previous five years' rate was 8·06 per 1,000. Ever since the introduction of registration this district has afforded similar results. It appears to be a normal ratio, of the causes of which no account has yet been given, although we have often called attention to it. In the same Mahanadi division is Bilaspur district, which registered a fever death-rate in 1881 of 25·12 per 1,000, against a previous five years' rate of 26·80 per 1,000. How happens it that these two normal rates vary so greatly? There is another district, Minar, which has a constant normal rate of about 28·20 per 1,000. It would repay all the trouble involved in an inquiry, if the climatic local and personal reasons of such facts could be assigned. But there are other ratios which have shown great reduction of late years, as for example the following :—

—			1878.	1879.	1880.	1881.
Nagpur	-	-	34·08	9·21	7·16	5·89
Betul	-	-	28·71	10·54	7·77	9·36

Nagpur town itself, with 84,441 inhabitants, had a fever death-rate of 3·58 per 1,000, and Betul town, with 4,593 people, had a fever death-rate of 5·66 per 1,000. In many towns the fever death-rates were below these numbers. We can scarcely arrive at an explanation of the facts, from the present state of the inquiry, and all that can be done is to discuss the question on general grounds, for it is quite possible that improved diagnosis might show that too many or too few deaths were classed under the fever heading, or that part of the higher rates were due to prevalence of the more severe and fatal fever types in some districts or localities.

As this matter is of considerable importance in the present state of sanitary work in these provinces, we shall give the facts bearing on it in the present report, beginning with the fever types.

13. Fever deaths in Wardah district averaged 16·46 per 1,000 in 1881, about 5½ per 1,000 under the previous five years' average. The Civil Surgeon of this district states as follows :—" In the month of September, just after the appearance of cholera, I noticed that with many of the remittent cases violent vomiting and diarrhoea preceded the setting in of the fever. So alarming were these symptoms to the patients, who knew of course that there was cholera about, that the friends and relatives,

"when they applied for medical aid, usually said that the person was suffering from cholera. The disease appeared to be modified to a certain extent by the same influences that produced cholera. These cases, if neglected, soon passed into a typhoid-like condition, only that after the first violent diarrhoea the bowels appeared to become obstinately costive."

In Jubbulpore district the fever death-rate was 19·27 per 1,000, against a previous five years' average of 22·38 per 1,000. The fever death-rate of Jubbulpore town, with a population of 43,223, was 16·59 per 1,000 in 1881. The Civil Surgeon describes the fever types as follows:—"Intermittent, especially tertian, was the most common form. Besides these we had under treatment the various forms of continued fever, from the mild febricula to the fatal typhoid. I cannot say that I have seen genuine cases of true typhus. . . . Cases of true enteric fever were much more common, every symptom being present, singling out the young for its victims, and causing death in those who were looked upon as most robust."

This remark, be it observed, relates to the Native population.

The Civil Surgeon, Nagpur, says, "As in former years, I have seen several cases of enteric fever. Some cases of intermittent and remittent fevers were very severe, and splenic enlargements common." On the other hand, the Civil Surgeon, Hoshangabad, states that obstinate cases of remittent were common. "Gastro-intestinal irritation, as also congestion of the liver and spleen, were very common concomitants of the fever; but in no case did I observe any properly so-called enteric symptoms."

The Civil Surgeon, Minar, describes the fever as of the "common intermittent type," with cases of remittent in the hot months. Civil Surgeons in other districts testify to intermittent with splenic or hepatic complications as being the more common types.

Malarial fever types of all degrees of severity, with complications and true enteric fever cases, ending in death, include the fever problems to be dealt with by sanitary proceedings: The facts scarcely account for the great losses of life entered under the head of "fevers" in the returns, and there is hence little doubt that many fatal cases in which there co-existed febrile symptoms with other fatal diseases found their way into the returns of fever. If we make any reasonable allowance for defects in registration and errors in diagnosis, we shall still have the very important element of diversity in local death-rates to deal with, diversities which, unless otherwise accounted for, lead directly to the question of local fever causes.

14. *Bowel Complaints.*—In 1881 there were registered 22,133 deaths under this head, or 2·98 per 1,000 of the whole population. The district death-rate was 2·91 per 1,000, and the town rate 4·13 per 1,000. Bowel complaint deaths were registered in all registration circles, but in only 7,535 population centres out of 27,247. This last fact throws doubts on the records, or on the diagnosis, neither of which can be removed at present. The monthly numbers registered as deaths from bowel complaints stood as follows:—

Months.			Bowel Complaint Deaths.	Months.			Bowel Complaint Deaths.
January	-	-	1,383	July	-	-	1,850
February	-	-	1,375	August	-	-	2,465
March	-	-	1,664	September	-	-	2,329
April	-	-	2,065	October	-	-	2,047
May	-	-	1,957	November	-	-	1,833
June	-	-	1,523	December	-	-	1,642

15. Two districts in the same division presented the same anomalies in their bowel complaint and fever death-rates in 1881 as they did in past years. We may reproduce the facts for 1881, and also for five previous years:—

Districts.	Death-rates per 1,000.				
	Fever.		Bowel Complaints.		
	1881.	5 Years.	1881.	5 Years.	
Sambalpur - - -	9·38	8·06	12·47	10·49	
Bilaspur - - -	25·12	26·80	0·46	0·61	

In former years we called attention to these facts as affording points of great importance in the sanitary history of these provinces. Some inquiry was made at the time, but without any result. The subject was, however, taken up by Dr. Brake in 1877-78, who left notes of sanitary inquiries extending over a month in Sambalpur district, and covering a distance of 200 miles, in the course of which attention was especially paid to the condition of villages, habits of the people, and the condition of water-supply. Dr. Brake recorded the results in the terms which follow:—"In every town or village visited he found that cattle were stabled at night within the house compounds on irregular ground without drainage. Manure kept in the compounds or house enclosures certainly for months, and in some cases seemingly for years. In no place did he see spaces outside villages set aside for the collection of refuse, sweepings, &c. In many of the compounds, more or less filled

“ with manure and rubbish of all kinds, including very offensive sour rice, the inhabitants had eased themselves as in latrines. The ground around and close to the towns and villages was generally foul, as were also the lands and bunds of the tanks supplying water for all purposes.”

Insanitary conditions such as these would account for any amount of predisposition to bowel affections, but it may be found that similar defects exist in districts where bowel diseases are not so fatal as in Sambalpur. This point might be inquired into. But, as already stated, a high death-ratio from bowel diseases is not the whole problem requiring elucidation. This includes a persistent low death-rate from fevers as well as a high death-rate from bowel diseases. It may be suggested as possible that some of these fatal bowel complaint cases may in reality be of fever types, ending in diarrhoeal states.

For example, the conjoint mortality from fever and bowel diseases, in Sambalpur district in 1881 was 21·17 per 1,000, and there are several other districts where the conjoint death-rates do not exceed, or even reach this amount. It may be, therefore, that the first step towards a solution of the difficulty in the case of Sambalpur, as well as in the Bilaspur example, may lie in improved diagnosis. This is merely thrown out as a suggestion which may be adopted in any future inquiry into the subject.

16. *Injuries*.—Death from suicide numbered 542, from wounds 2,225 and from snake-bite and wild beasts 1,190; in all 3,925, or 0·53 per 1,000 of the population.

17. Under the head of *all other causes* there were entered 60,488 deaths, equal to 25 per cent. of the total mortality of the year. In the Punjab it has been found that a considerable part of this large unclassified disease group can be separated under the head of respiratory diseases. The disease history of 1881, in the present state of registration, scarcely requires more detailed notice, and we shall next discuss the progress made during the year in sanitary work.

18. *Sanitary works (Civil)*.—In the Central Provinces there are 72 population groups entered in the statistical tables under the designation of towns. But in reference to 19 of these only is there a return made of the municipal expenditure. Their population is about 400,000, and their income about 52,000*l.*, of which 12,340*l.* was spent on conservancy. The actual cost per head of the population per annum varied from about 2*d.* to 1*s.* per head. When it is considered that cleanliness is simply a domestic duty, which every family should provide for itself, or pay for, it cannot be said that the outlay under this head was excessive. Further advances were made during the year in improving existing wells, and constructing new ones. A list is given of 48 tahsils in the districts, in 29 of which improvements in water-supply were carried out. They were limited, however, to 507 villages, only a very small proportion of the total villages in the provinces. The nature of these well improvements will be sufficiently understood from the following details. Repairs were effected in 353 existing wells, and 191 new wells were constructed. The number is very small for the population, but on the other hand this important work has been carried out year by year for many years past.

19. The present condition of the water-supply may be in some sense estimated from these facts. The returns include water sources of 23,856 villages, and these sources are as follows:—

Number of villages drawing water from:—

Pucka wells	-	-	-	-	-	4,567
Kutchra wells	-	-	-	-	-	5,691
Tanks only	-	-	-	-	-	4,224
Running streams only	-	-	-	-	-	5,260
Running streams ceasing in hot weather	-	-	-	-	-	3,308
Using notoriously bad water	-	-	-	-	-	269



For reasons which we have often stated, it is an essential condition of improved water-supply for Indian towns and villages that the immediate subsoil water be cut off from the well, so as to draw upon the deep sources only, unless new wells are formed in clean ground, and at a distance from all surface impurities. Of course it is always safer to bring good water from a distance, as has been done in the case of Nagpur, which has the great advantage of deriving its supply from waterworks executed some years ago. Mr. Brake, the Civil Surgeon, reports that the waterworks “are more and more appreciated; every month applications are entertained from householders seeking a special supply for their private establishments; and during the year nine new standards have been erected, two by persons for their own use, and at their own expense, amounting to Rs 1,212, and seven others by charitable individuals for the use of the public, at a cost of Rs. 2,177.” In other towns some consideration appears to have been bestowed on the construction of waterworks, but in Nagpore alone have works been completed. There is a near prospect, however, of a similar advantage being extended to Jubbulpore, which is to receive its supply from a reservoir seven miles from the city. This work has been actively carried out, and it is to be hoped that early in 1883 the first supply will be turned into the city. The estimated cost is 60,000*l.* Khandwa and Burhanpur have water reservoirs, but there has been no water distribution, properly so called, as yet. In the former case water is raised by steam power.

It will be seen that some progress has been made in providing the larger population groups with pure water brought from a distance and distributed by pipes. For villages, the only resource is to construct wells on the principles laid down in our “suggestions,” which if fully carried out would make well supplies perfectly safe for limited populations.

20. As the new local and district authorities for the Central Provinces will be in action shortly, it may be useful to give a very brief outline of works in progress in some of the districts, the sanitary defects brought to light by inspections, and the chief sanitary measures which, as shown by the facts, may be at once carried out.

In *Saugor* district many wells were cleansed, deepened, and provided with parapet walls and gratings. Many defective drains were cleansed and repaired, dry-earth latrines provided, and the sewage trrenched at a distance.

In *Damoh* similar improvements in water-supply were made. "In some places magnificent structures of this kind (wells, water sources) exist, requiring little repair, but, as a rule, neglected and uncared for, no one being responsible for their preservation."

Jubbulpore.—"Arrangements for conservancy reported as most satisfactory. The municipalities at *Sehora* and *Murwara*" have improved the drainage and conservancy of the towns very considerably.

Narsinghgarh.—"All roadside and camping ground wells, and all others within municipal limits, were cleaned and repaired during the year."

Birman fair was held on the 10th January 1882, and came to an end on January 24th, in consequence of intelligence of cholera having appeared at the great Mela at Allahabad. On the bathing day 60,000 people were present, the usual medical and sanitary arrangements were carried out, and there was no epidemic disease; only 22 cases of ordinary complaints were treated.

Hoshangabad.—Many new wells were made in the course of the year. Bowel complaint deaths are said to be more frequent among persons using *Nerbudda* water, but this fact, if it be one, admits of proof, and its reasons can also be shown. In the district villages the purity of well water is chiefly endangered by surface filth, the wells not being protected by copings. In the town itself drains and conservancy appear to be well attended to.

Nimar.—Of the *Sadhr* town the civil surgeon states that square sectioned drains have been in use, "the worst description that could be adopted, constantly breaking, difficult to clean, and with their levels by no means correctly laid."

The greater part of *Burhanpur* has been drained. "A very fair system of removing night-soil and road sweepings exists and these are all utilised." But "refuse water from the houses is allowed to run into the open roadside drains, and as this is frequently mixed with urine and excreta, and as there is no way of flushing these drains, and, further, as the drains themselves are out of level and badly constructed, the foul water lodges and contaminates the atmosphere." In the town people still use privy wells, and attempts to introduce the dry-earth system have failed, as the people will not use the earth.

Burhanpur contains some 30,000 inhabitants. Its five years' average death-rate was 40·65 per 1,000, but in 1881 it was only 21·94 per 1,000, 10·88 of which was due to fevers.

Betul.—There appear to be no latrines in the district for want of funds.

Chindwara.—Considerable drainage improvements have been carried out. Many narrow streets have been widened and new ones opened up. Conservancy of private houses is carried out by the municipal establishment.

Seoni.—Sanitary condition of town "much improved:" filthy water holes filled up, and drains cleaned and deepened. Dry-earth public latrines in use.

Mandla.—"Water-supply abundant." Water sources in villages generally well cared for.

Bhandhara.—Lower castes, who are prohibited from drawing water from wells, use any kind of water they can get. Wells for low-caste people should be constructed.

Nagpur.—We have already mentioned the *Nagpur* waterworks. There is no account of any drainage arrangements, but the conservancy is fully carried out, and the dry-earth system enforced.

Wardah district.—Hinganghat waterworks approaching completion.

Chanda.—Water-supply abundant and protected from impurity. Water pipes from *Ramala* tank repaired; public drains repaired.

Raipur.—Trial wells yielded water with "26 per cent." of carbonate of lime per gallon, with superabundance of chlorine and albumenoid ammonia. There seems to be some mistake in reporting the analysis, but any way the water is unfit for use. Two swamps were drained. Dry-earth latrines were extended.

Bilaspur.—Drainage to be improved, but no funds available at present.

From these abstracts it will be learned that the chief improvements which have been carried out have been those connected with water-supply. This, no doubt, is a very important part of the work, but it is not all, or anything like all, the sanitary work required in these provinces.

21. In previous years the Sanitary Commissioners have no doubt described the actual condition of the many population groups, and their reports should be referred to for the facts. In the report under review are given the results of a number of inspections made by the Sanitary Commissioner himself, by the civil surgeons, and also by vaccination officers, which may be briefly condensed as follows, beginning with those sent in by the vaccinators, which are chiefly confined to describing the villages in their respective districts, of which upwards of 1,000 were inspected, notes of their sanitary condition made, and advice given as to improvements required.

These officials have received a simple training in sanitary knowledge at the *Nagpur Medical School* which they are required to put to useful purpose while engaged in their proper vaccination work. It cannot be expected that their estimates of local causes and their influence on health should be those of thoroughly trained sanitary officers, but, nevertheless, they are doing good work. They report a large proportion of the inspected villages as dirty, animals kept in houses or compounds, and in many instances the water-supply bad or liable to pollution. Their work, humble as

it is, may be productive of much benefit when they have had more practice in it. The Sanitary Commissioner states that, "on the whole, the vaccinators appear to have done fair work in advising the people of the villages on matters of sanitation. . . . There is every reason to believe that some good has been already effected, and that the vaccination staff, if properly supervised and kept to their work, will prove a most valuable aid in this direction, and that ultimately substantial progress will be made in village sanitation."

22. The reports of civil surgeons were expected to give the results to health of the observed sanitary condition of improved and unimproved localities. We suggested this subject of inquiry in consequence of instances of apparent unusual healthiness in the provinces, but the civil surgeons have rather reported on the general sanitary conditions of towns and villages visited by them. A large amount of useful work was done by them in this matter, but it is unnecessary to give details, as these do not differ except in being more specific from those of the vaccinators. Many villages were found in a bad condition, and had suffered much from epidemics. Others were in a better state, but the general result of the reports is that much requires to be done before population groups in these provinces can be considered safe from epidemics.

The civil surgeon of Wardha describes four cases of fever of so unusual a type that they were considered on the spot to be a new disease. The cases occurred in a village of 96 huts situated on a mountain range. The first case was in a young man 27 years of age, who was attacked on the 3rd or 4th February 1881 and died on the 8th or 9th. The day before he was attacked he had travelled 20 miles in a cart in the heat of the day, under a temperature probably of 97° in the shade and 119° F. in the sun. He went to bed apparently well. Next morning he complained of severe headache and fever of continued type, with burning heat of skin, then followed bleeding from the nose, and vomiting of dark blood, which was also passed by the bowels, body became cold, face and whites of eyes yellow, urine in small quantity and very yellow. Insensibility with open eyes, with picking of bed clothes, took place on the third morning, and he never recovered consciousness.

The next case, aged 22, was taken ill on the 12th February and died on the 14th. This young man had been labouring in the fields the day before seizure. He suffered from fever and headache, together with constant vomiting of green and yellow liquid and subsequently of blood. There was no bleeding from the nose or bowels.

The next case resembled the first one in its symptoms. His age was 27 or 28; he was taken ill on the 14th February and died on the 19th.

The last case was in a carpenter, 28 years of age. He travelled in the heat some 25 miles on the 27th February; was taken ill on 1st March. The case went through the same stages as the first, and he died on 8th March. There were no more cases. No persons who were about the cases suffered, and, except the heat, there was no cause apparent which did not apply equally to unaffected persons.

On the 18th December 1880, a boy, four years of age, was admitted to the Mayo hospital, with no fever, bleeding from the nose, coffee coloured vomit, with blood clots, petechiæ, enlarged spleen, and intensely yellow skin; he died on the 20th, seven days after attack.

The cases were few in number, only five, and all died. There were no remissions. The fever type was not agreed on by medical officers, and we have thought best simply to give a brief statement of the facts.

23. The Sanitary Commissioner's account of his own inspections is much fuller than the accounts supplied by other officers, and he has introduced important suggestions on local sanitary measures connected with latrines and trenching, which will, no doubt, receive attention from the new local authorities.

24. These are the chief points calling for remark in the present year's report, and if, as a whole, the report is not altogether of a satisfactory nature, the cause must be sought in rapid changes of officers, and not in any want of zeal on the part of the new Sanitary Commissioner, who has obviously done the best he could under the circumstances.

25. It may not be out of place to conclude the present memorandum with a general outline of the sanitary work with which the new district authorities will have to deal, premising that it is absolutely indispensable that steps should be taken to correct the local strength of population already referred to, and to calculate per-centages of births and deaths upon the corrected numbers for every district and town. If this is not done there will be no reliable data on which to rest evidence of improved health, or to show whether local funds have been expended to the best advantage.

In the meanwhile, it would be advantageous to prepare tables showing the causes of death and the death-rates for a series of years past for every town and district, so that the authorities may at once be made acquainted with the sanitary problems with which they have to deal.

26. The great causes of sickness, death, and loss of labour in the provinces are all included under the general head of "fevers." Cholera epidemics are only of occasional occurrence, although cases may happen at any time.

Small-pox is a more constant visitant, as are also diseases classed as "bowel complaints," but all are of less importance than fevers, while in removing the local causes of "fevers" there will be a reduction in the mortality of other epidemic diseases. Fevers, as is well known, are connected with climatic causes which also influence crops, and hence means should be adopted for making local

authorities acquainted with current meteorology. But the local intensity of fevers is mainly connected with purely local defects in drainage, and perhaps still more with local insanitary conditions which influence the mortality of febrile diseases in all countries and climates. In the Central Provinces these local causes may be classed as follows :—

- (1.) Filth in houses and compounds (including the results of stalling cattle in them). Surface filth in towns and villages outside houses, arising mainly from native habits.
- (2.) Impure well and tank water resulting from human and animal filth being washed into tanks or wells, or finding its way by subsoil drainage from house cesspits, or from foul ground into which the wells has been sunk.
- (3.) Irregular and foul earth surfaces near inhabited dwellings, water holes, old buildings, and the like, harbouring filth and water.
- (4.) Absence of surface drainage in towns and villages, and allowing foul house drainage to flow over the surface; and water from higher levels passing into the subsoil under houses.
- (5.) General defects in human dwellings, including damp subsoil and damp walls, and sleeping on the ground.

27. Judging from past sanitary reports, these disease causes appear to have presented themselves most frequently to the notice of inspecting officers, and no doubt they include the chief disease causes with which the new executives will have to deal. A mere statement of them ought to carry the remedies with it, but we may resume them in the following order :—

- (1.) Provision of latrines, or of properly trenched and cultivated ground, should be at once made.
- (2.) Some method of keeping cattle out of compounds, but still near enough for convenience, together with collection and removal of manure, should be provided.
- (3.) Following on these facilities, cleanliness in houses, compounds, streets, lanes, public roads, open spaces in towns and villages, should be rigidly enforced, and all cesspits at once filled up. First provide facilities for cleanliness, and then enforce the law.
- (4.) The water-supply of every population group should be looked to. New wells should be dug in new clean ground. Tanks should be cleansed and protected, or water-works laid out, of which several good examples will shortly be found in the provinces, and as soon as these facilities have been afforded, all house wells near house cesspits should be abolished.
- (5.) It is a matter of prime necessity that water for domestic use brought into any population group should be drained away, and not be allowed to sink into the subsoil to increase subsoil malaria. Some provision of drainage should therefore form an integral part of all water-supply schemes.

For small population groups impervious surface drainage, led to an outlet where the drainage could be applied to agriculture, would be the best.

There are several examples of this method in use in the Central Provinces at present.

- (6.) Large drainage schemes are mostly applicable to large cities, where they would be less expensive probably than partial measures. It would be worth while, however, to examine the question of drainage works in the populous cities, such as Nagpur and Jubbulpore, where large volumes of water are brought from a distance, which must be removed to a distance after use, and so kept out of the subsoil.
- (7-) In all population groups water holes should be drained and filled up, and surfaces levelled, and surface drained. Where groups of houses stand on wet and damp ground, trenching or draining should be adopted.
- (8.) Tree planting would afford not only a ready means of drying damp ground not admitting of drainage, but it would afford shade and pleasure to all town and village populations.
- (9.) Damp floors of houses can always be inexpensively raised above the outer ground level, and the people might be induced to raise their sleeping places above the floors.
- (10.) Surface drainage requires smooth well formed road surfaces with side drains to carry off rainfall.

28. Details on all these improvements will be found in the revised suggestions of this Commission for the sanitary improvement of Indian stations and their vicinity (1882).

The principles therein contained will be found applicable to sanitary works of all degrees of importance, but for the great majority of cases very simple measures, such as those we have suggested therein, for small municipal towns and villages would probably suffice.

11th June 1883.

No. 8.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER of the HYDERABAD ASSIGNED DISTRICTS for 1881.

1. The vital statistics of these Hyderabad Assigned Districts for 1881 are calculated on the census population of the same year. But as the officiating Commissioner points out, they are still to a certain extent unreliable on account of registration errors, especially in towns, and the population of Melghat not under registration is not included.

The registered births and deaths for 1881 were obtained from the following numbers:—

Population 1881.					
Males	-	-	-	-	- 1,358,275
Females	-	-	-	-	- 1,271,748
Total	-	-	-	-	- 2,630,018

This is the population included in six districts, having a conjoint area of 16,062 square miles. A previous census was taken in 1867, and during 15 years which have elapsed since then, population has increased by 443,030, or about 1·46 per cent. per annum.

Population according to classes in 1881 stood as follows:—

Christians	-	-	-	-	- 1,330
Mahomedans	-	-	-	-	- 186,033
Hindus	-	-	-	-	- 2,405,073
Other classes	-	-	-	-	- 37,582
Total	-	-	-	-	- 2,630,018

2. The year's births were of—

Males	-	-	-	-	- 53,659
Females	-	-	-	-	- 51,262
Total	-	-	-	-	- 104,921

Equal to a ratio of 39·9 per 1,000. The English birth-rate, which is not a low one, is 35½ per 1,000, and before it can be admitted that Indian rates exceed this proportion we should have to be assured of registrative accuracy. Need of this is further shown by the diversity of birth-rates, which range between 46·8 and 54·1 for rural circles, and between 29·6 and 40·8 per 1,000 for towns.

3. In 1881 there died—

Males	-	-	-	-	- 40,930
Females	-	-	-	-	- 35,731
Total	-	-	-	-	- 76,661

The male death-rate was 30·1, and the female death-rate 28·1 per 1,000. The conjoint rate was 29·1 per 1,000. The lowest death-rate of the year, 25 per 1,000, was registered in Wun district, and the highest, 33·1 per 1,000 in Akola. The birth-rate of 1881 exceeded the death-rate by 10·8 per 1,000.

There are still some acknowledged defects in registration, but several improvements have been since introduced.

4. *Chief diseases.*—The following were registered death causes in 1881 compared with those of 1880:—

Diseases.	Total Deaths.	
	1880.	1881.
Cholera - - - - -	1	3,404
Small-pox - - - - -	39	225
Fevers - - - - -	31,027	41,681
Bowel complaints - - - - -	7,997	11,951
All other causes - - - - -	12,661	19,400
Total - - - - -	51,725	76,661

There was as apparent increase of 24,936 deaths, not far short of a third over the preceding year's deaths, which may have been partly due to better registration, but the probability is that 1881 was a year of increase of epidemic, as it certainly was of two well known epidemic diseases, cholera and small-pox. We shall state briefly the leading facts under each of these heads.

5. *Cholera*.—The following abstract gives the history of cholera mortality for the last 14 years in Berar :—

Years.					Total Deaths from Cholera.	Cholera Deaths per 1,000 of Population.
1868	-	-	-	-	5,447	2.9
1869	-	-	-	-	10,947	5.2
1870	-	-	-	-	504	0.22
1871	-	-	-	-	581	0.2
1872	-	-	-	-	1,578	0.7
1873	-	-	-	-	—	—
1874	-	-	-	-	2	0.0009
1875	-	-	-	-	22,465	10.2
1876	-	-	-	-	2,683	1.2
1877	-	-	-	-	842	0.4
1878	-	-	-	-	34,306	15.6
1879	-	-	-	-	228	0.1
1880	-	-	-	-	1	0.0004
1881	-	-	-	-	3,404	1.3

This table is remarkable for the annual differences in cholera mortality which it displays. No deficiencies in registration would account for them. They show a tendency to triennial periods subject to sudden augmentations in intensity, for which at present no reason can be assigned unless the facts be taken to show that the most predisposed part of the population are suddenly cut off, and then the disease subsides for a time.

6. Past cholera history shows that certain localities are far more liable to losses from this epidemic than are others. The facts for each of the six districts have been as follows :—

Districts.					Deaths per 1,000.	
					1881.	1868 to 1880.
Amraoti	-	-	-	-	0.7	2.5
Ellichpur	-	-	-	-	0.4	1.8
Wun	-	-	-	-	0.8	1.9
Basim	-	-	-	-	1.2	4.4
Akola	-	-	-	-	1.6	2.8
Buldana	-	-	-	-	2.8	3.4
Total	-	-	-	-	1.3	2.8

This abstract, prepared by Dr. Little, the Sanitary Commissioner, raises not a few important points in cholera history, and it might repay the trouble if some attempt were made to ascertain the reasons of these very marked differences in topographical distribution, extending as they appear to have done over so many years.

7. The next abstract shows the monthly prevalence of cholera in 1881 compared with rainfall, and with its monthly prevalence for the preceding 14 years.

Months.					Total Cholera Deaths.		Rainfall in 1881.
					1881.	14 Years.	Inches.
January	-	-	-	-	—	868	0.78
February	-	-	-	-	—		
March	-	-	-	-	—		
April	-	-	-	-	—	1,915	0.11
May	-	-	-	-	—	4,122	0.32
June	-	-	-	-	1	11,518	9.13
July	-	-	-	-	245	25,529	9.49
August	-	-	-	-	1,744	25,512	8.06
September	-	-	-	-	1,064	10,170	4.03
October	-	-	-	-	217	2,608	1.43
November	-	-	-	-	50	779	1.31
December	-	-	-	-	83	472	—

The period of maximum intensity of cholera appears to be very much the same in the epidemic years. The town cholera death-rate in 1881 on a population of 138,378 was 1.9 per 1,000, representing 272 deaths. The country deaths were 3,132, or 1.3 per 1,000 on a population of 2,491,640. Several towns had no cholera deaths; but in Malkapur and Akola towns the rates were very high, viz., 8.1 and 9.8 per 1,000 respectively. As already shown, all the districts yielded cholera deaths, but these were registered in 96 out of 137 registration circles. In Amraoti district deaths were registered in 46 villages, but the total villages in this district are not stated. In the remaining four districts there are 4,469 villages, of which 391, or 8.7 per cent, returned 3,024 deaths. In the

preceding table we have added the monthly rainfall for 1881. The data appear to show that in these districts the influence of want of rain, and also of increase of rain, on augmentation and diminution of cholera mortality are experienced later than in other districts of India.

8. We shall next state briefly the history of this epidemic outbreak.

In the preceding table, a single death from cholera is entered under the month of June. The patient, a Eurasian, arrived at Khamgaon, a town in Akola district, from Bhosawal, where cholera prevailed. He was seized three hours after arrival, and died on the 25th June. No other case followed this one, which was clearly an imported one.

The real epidemic began in July in the village of Anthree, in Buldana district, 36 miles to the south-west of Khamgaon, and without any connexion with the first case in that town. The patient, a Mahar boy, aged five, "was taken ill on the night of the 7th July, and died on the morning of the 9th. The next case was of a woman living next door. She was attacked on the 9th, and died on the 10th. The third case was also of a woman, aged 60, living at the opposite end of the village, and it also proved fatal. The disease then spread throughout the village, and prevailed up to the 19th August, the date on which the last attack occurred. The total number of attacks in this village out of a population of about 170 was 69, of which 33 proved fatal." The Civil Surgeon, Buldana, who examined into the circumstances attending this outbreak, reports that "the first case was plainly indigenous, and was the first attack in the district. No person affected with the disease had come to the village, nor had the people of the village gone to any place where the disease was prevailing." This account is of much importance as giving the history of a pure village attack, but it was only a part of an epidemic which prevailed in Khandesh in Bombay Presidency, where 60 villages attacked in July yielded 716 cholera deaths, while, in August, 196 villages in Khandesh yielded 1,847 cholera deaths.

Buldana district marches with part of Khandesh, and no doubt was under the same epidemic conditions, while, as regards the attacked village, Anthree itself, "the sanitary state of the village was bad, and it is stated to have been in a filthy condition at the time of the outbreak The water-supply was abundant from wells, but surface drainage found its way into the majority of these."

The next reported cases took place in a wandering tribe belonging to Loharra, in Amraoti district of Berar. They were 23 in number, and had returned to Berar, after having made a circuit through part of Khandesh, where cholera existed at the time. They themselves, however, stated that there was no cholera where they had been.

They arrived at Khamgaon, in Berar, all well on the 8th July on their way home. Next day, the 9th, one of them, a woman, was taken ill and died on the 10th, but the medical officer who saw the case said it was not cholera. Another of the tribe was taken ill with cholera in Khamgaon, and was carried to a village, Ambikapur, 11 miles distant, where he died. In this village another of the party, a boy, was attacked, and recovered. The man died on the 12th July at Ambikapur, but, on the 11th, cholera had broken out in the village, and lasted till 5th August. The population was 991, and they yielded 23 attacks and five deaths. In Khamgaon town, cholera broke out on the 24th July, and ceased on the 29th August, after causing 98 deaths out of a population of 8,472. It is stated that there had been no communication with the sick of the tribe at this town (there was only one case in the tribe, which was removed before death).

Cholera did not break out in any village through which the wanderers returned home for a month afterwards. The next outbreak took place in a group of villages, 42 miles from Ambikapur, the nearest infected locality. It appeared on the 12th July, the same day the wanderer died in Ambikapur. One of the attacked places, Malkapur, is situated on a line of railway in daily communication with Bhosawal, where cholera was prevailing, but the Civil Surgeon states that "the earliest cases in Malkapur clearly occurred in people who had no communication with Bhosawal or with affected persons from that place."

The first case reported in Amraoti district was that of a Bunniah, who had been to Punderpore fair, in Poona district, whence he travelled by rail through a cholera infected locality. He arrived at his home on 20th July, and died on the following day. The day after his death, a woman in the village was attacked and died in a few hours, and three others, who recovered, were attacked in the same house, with this woman. The sanitary state of the village was bad, "cattle and poultry shared the dwelling-houses with their owners," and there was no drainage.

These cases refer to the first appearance of cholera in districts in Berar; several others are given of a similar character, but the districts themselves are very small areas within a region where cholera prevailed epidemically. The first registered death took place in Akola district, one of the six districts into which Berar is divided in June 1881. In July four of the six districts were attacked. In August, September, and October the whole six districts suffered. In November four of them yielded deaths, and in December two. August was the month of maximum mortality. The cases of presumed spread by communication were carefully examined, but from the results arrived at they appear to have been simply part of a moving epidemic which covered part of Bombay Presidency at the same time as it did Berar.

The disease appeared in Khandesh, in Bombay Presidency, in March, and attacked a single village, where 11 cases proved fatal. In May another village was attacked, and yielded seven deaths. In June, when the first death was registered in Berar, two villages were attacked in Khandesh, and yielded 59 deaths. In July, the epidemic extended over both Berar and Khandesh. In the latter

district, in Bombay Presidency, 60 villages were attacked in this month, and 716 deaths were registered; and in Berar 237 villages yielded 245 deaths from cholera in July. There was nothing in the facts to justify a recommendation of one Civil Surgeon, that the moving tribe of beggars should have been placed in quarantine, or that any influence could have been exerted by any similar procedure on the course of this epidemic.

9. The history of cholera in Khamgaon town was carefully reported on by Mr. Steinhoff, medical officer, who states, "that immediately preceding the advent of cholera there had been an unusually large number of cases of diarrhoea, colic, and indigestion treated at the dispensary." The first fatal case was that of the woman belonging to the wandering tribe already referred to, which, however, was not true cholera. Nine days after this case, on the 18th July, cholera broke out simultaneously in five different quarters of the town and quickly spread. It lasted in all 34 days. There were 313 cases and 98 deaths. Dr. Little sums up the history of cholera progress in the Berars, as follows:—"The disease did not spread from one centre. In every district almost the first cases were in villages at a distance from large centres of population and main lines of communications."

As has been already shown, a remarkable feature of cholera epidemics in Berar is the very great variations in annual death-rates. Climatic and local conditions remain, no doubt, much the same from year to year, and without any assignable cause an epidemic which sweeps off upwards of 34,000 people may be followed two years later by a single death. It would appear from the facts already given that time is probably an element in bringing about predisposition to attacks of cholera, that is, on the supposition that the cause is constant, or else that the cause itself, whatever this may be, is liable to great variations in intensity. So far as information on the subject is supplied by this report the usual insanitary local conditions were met with by Civil Surgeons in all places where cholera was severe.

10. *Small-pox*.—Deaths from this epidemic disease were registered chiefly in Akola district, where 196 deaths out of a total mortality of 225 took place. One district, Basim, escaped entirely. The disease was limited to 25 registration circles out of 137, and in four out of five attacked districts all the deaths, 219 in number, were returned from 74 villages out of 3589. Of registered deaths 104 took place in children under one year of age. The death-rate of the year was 0.1 per 1,000 of the population, or just one twelfth part of the preceding five years' ratio.

Berar is one of the Governments in which much good vaccination work has been done, especially in children, and we may here introduce the following totals of a table given by Dr. Little in which annual small-pox deaths are compared with the ratio of vaccinations to births for a series of years:—

Years.					Small-pox Deaths per 1,000.	Ratio per Cent. of successful Vaccinations to total Births.
1869	-	-	-	-	3.6	24.6
1870	-	-	-	-	0.63	13.2
1871	-	-	-	-	0.20	29.2
1872	-	-	-	-	3.8	53.5
1873	-	-	-	-	3.8	58.5
1874	-	-	-	-	0.5	41.6
1875	-	-	-	-	0.4	58.5
1876	-	-	-	-	0.2	63.7
1877	-	-	-	-	2.9	77.6
1878	-	-	-	-	2.7	81.1
1879	-	-	-	-	0.03	71.9
1880	-	-	-	-	0.02	72.8
1881	-	-	-	-	0.10	—

This table yields several important facts in small-pox history. It shows first a tendency to biennial epidemics. Secondly, that during the latter half of the period in this table, small-pox death-rates have fallen to one half what they were in the earlier half, and that the proportion of vaccinations to births has about doubled during the last six years of the period. Next year's experience ought to furnish important facts in small-pox history. Besides recurring biennial epidemics it will be seen that the last of these was less severe than the previous one, and if 1882 shows a recurring epidemic of less force than any preceding one, we shall have adequate proof, not only that vaccination diminishes current mortality from small-pox, but that it does so during epidemic periods as well as during times of low epidemic intensity. Any way the table affords proof that great attention has been paid of late years to vaccination, and that there has been a coincident falling off in small-pox mortality.

11. It is worth while to introduce the following facts regarding Basim district, which escaped small-pox altogether in 1881. During six years following and including 1869, the annual percentage of vaccinations to births was in round numbers 45.6, and the annual small-pox death-rate was 2.14 per 1,000 of the population. In the six following years the vaccinations to births averaged 88.8 per cent., and the small-pox deaths were 0.65 per 1,000 of the population, with the rate disappearing altogether for one year, 1881, at least.

We must, however, wait for further experience.

The monthly incidence of small-pox, mainly made up of deaths in Akola district was as follows :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - -	3	July - -	35
February - -	9	August - -	11
March - -	29	September - -	5
April - -	19	October - -	2
May - -	38	November - -	3
June - -	43	December - -	28

Akola district yielded nearly 90 per cent. of the year's mortality, and its average percentage of vaccinations to births for the last six years has been $55\frac{1}{2}$, or 33 per cent. under the Bassim rate. It is necessary to state the facts.

12. *Fevers.*—Diseases registered under this head were returned from every registration district, and from every circle. The number of villages registering fever deaths was not returned for Amraoti district, but in the other four districts fever deaths were returned from 3,380 villages out of 4,469. As usual, every month in the year yielded fever deaths, as is shown by the following table in Dr. Little's Report, which also gives the chief climatic elements in comparison with the mortality :—

Months.	Mean Temperature.			Rain Inches.	Fever Deaths.
	Max.	Min.	Range.		
January - - -	62° 07	56° 4	20° 4	—	2,526
February - - -	88° 3	62° 1	26° 1	0° 01	2,449
March - - -	71° 3	65° 7	21° 5	1° 19	2,564
April - - -	100° 9	74° 8	26° 1	0° 17	2,966
May - - -	104° 0	77° 9	26° 1	0° 42	3,284
June - - -	90° 0	72° 6	17° 4	12° 49	2,148
July - - -	82° 8	70° 4	12° 4	13° 68	2,795
August - - -	81° 4	70° 4	11° 0	10° 22	4,587
September - - -	83° 9	69° 6	14° 3	4° 20	5,387
October - - -	86° 0	65° 0	21° 1	2° 37	4,750
November - - -	81° 2	57° 8	23° 5	0° 96	4,263
December - - -	80° 8	53° 4	27° 3	—	3,963

On the supposition that these data are close enough approximations for practical purposes, they afford information of importance. They show clearly that, in Berar at least, high temperature ranges do not rank immediately as fever causes, for the highest fever death-rates were by no means coincident with the highest ranges, but rather the contrary; consequently they show that neither high temperatures nor low temperatures rank as efficient fever causes in Berar. The one climatic element which takes the lead as a fever cause is cumulative rainfall. Heavy rain coming over a dry subsoil does not produce fever. The rain must fall in sufficient amount to water-log the ground, and it must have time to do so, and then when rain begins to fall off and evaporation to take its place, not only is there the action of malaria, but of falling temperature and increasing temperature ranges also, and fever mortality rises. When rainfall decreases in the latter months of the year temperature range appears to come into operation.

13. Of course, in any discussion about fever causes, allowance must be made for the present condition of death registration, because in Berar, as in other Indian districts, "many of the deaths registered under that head were due to other diseases, such as measles, bronchitis, and pneumonia, where fever was a prominent symptom."

Still the deaths took place, and they were apparently influenced as to number by climatic causes, and admitting this fact, the fever deaths would nevertheless form the great bulk of the mortality. "Dr. Little tells us that the fever itself is of "malarious origin," that the type is intermittent and "remittent, more especially the latter, and that in fatal cases brain or lung complications early set in." Moreover, that "this year's experience further goes to prove that, (a) these so-called malarious fevers are endemic, (b) that they are influenced and chiefly dependent upon heat, moisture, and "rapid alterations of temperature, and (c) that they are not communicable."

Those suffer most who are "ill-fed, ill-clothed, and who sleep on the damp ground. . . . The Natives themselves recognize the effect of cold in producing fever, and they also attribute it to a great extent to bad water, and particularly to the water of streams flowing through *sendi bunds*

“(groves of date palm).” If the registration were altogether reliable, the following annual deaths would give the law of fever recurrence in Berar:—

Years.				Fever Deaths.	Years.				Fever Deaths.
1868	-	-	-	10,936	1875	-	-	-	26,076
1869	-	-	-	12,917	1876	-	-	-	39,875
1870	-	-	-	23,023	1877	-	-	-	34,453
1871	-	-	-	18,125	1878	-	-	-	85,260
1872	-	-	-	31,853	1879	-	-	-	32,475
1873	-	-	-	19,242	1880	-	-	-	31,027
1874	-	-	-	26,732	1881	-	-	-	41,681

During the last seven years of the series registration appears to have been better attended to, the fever-rates are higher than those of the previous seven years, and they show also the influence of scarcity of food during 1878.

14. The lowest district fever-rate of the year was in Buldana district, namely 13·7 per 1,000, and the rainfall in this district, 26·20 inches, was less than in the others. The highest fever death-rate, 21 per 1,000, was in Wun district, where the rainfall reached 44·11 inches. Referring to this fact the Sanitary Commissioner remarks that “in the Wun district the villages use charpoys for sleeping on to a very much greater extent than in any other district of Berar, yet the fatality from fevers is always highest in this district.” This apparently exceptional result may possibly be due to local conditions of surfaces and subsoils, but it may also depend in part on the law of rain distribution, for, if the mass of the year’s rain in Wun falls just before the time of increase of fever in other districts, Wun may suffer to a greater extent from this cause. All such exceptional cases merit investigation, because they may throw important light on sanitary work. But it must also be borne in mind that a great part of fever mortality everywhere, and especially in Indian towns and villages, is due to aggravation of fever cases by purely local causes in and around dwellings.

15. *Bowel complaints.*—Diagnosis of bowel complaints is still in an unsatisfactory condition, but there appears to be a nearer approach to accuracy in this matter in Berar than in several other parts of India. There were 11,951 deaths registered under the heading in 1881, equal to a death-rate of 4·5 per 1,000, as against a previous five years’ ratio of 6·5 per 1,000. All the districts registered bowel complaint deaths, as did also 130 registration circles out of 137, but the usual anomaly is presented of these deaths occurring among a limited number of population groups. Deaths are returned by villages in four only of the districts containing 4,469 villages, and bowel complaint deaths were registered in 1,416 of them. It is important to contrast the ratios between the different districts side by side with the fever death-rates on account of a similar relation existing between them as takes place in the Central Provinces.

16. The following abstract gives the average ratios for a period of five years:—

Districts.				Death-rates per 1,000 5 Years.	
				Bowel Complaints.	Fevers.
Amraoti	-	-	-	6·7	20·7
Elliehpur	-	-	-	7·4	22·3
Wun	-	-	-	1·3	23·1
Basim	-	-	-	5·0	14·2
Akola	-	-	-	11·2	23·1
Buldana	-	-	-	5·0	17·6

Wun district presents ratios between bowel complaints and fevers the reverse of those in Sambalpur district in the Central Provinces. In Sambalpur the problem has been to determine the reason why bowel complaints are so fatal, and in Wun the problem is to determine why there are so few of these deaths. In 1881 bowel complaint deaths in Wun were only 0·6 per 1,000, while the fever deaths were 21·1 per 1,000, the highest district rate of the year. Perhaps some light might be thrown on the figures by further inquiry.

17. The following were the monthly deaths from bowel complaints for the whole province in 1881:—

Months.		Deaths.	Months.		Deaths.
January	-	584	July	-	1,045
February	-	595	August	-	1,989
March	-	618	September	-	1,969
April	-	595	October	-	1,383
May	-	669	November	-	1,034
June	-	508	December	-	1,962

So far as these data are reliable, they appear to show that the same climatic and local causes which augment fever mortality during the last six months of the year influence in a similar manner the death-rates from bowel complaints.

18. *Injuries*.—Under this head were included—

Suicides	-	-	-	-	-	181
Wounding	-	-	-	-	-	38
Accidents	-	-	-	-	-	578
Snake-bite and wild beasts	-	-	-	-	-	222
Total	-	-	-	-	-	1,019

19. *Other causes*.—Under this very unsatisfactory title were registered 18,431 deaths, or 7 per 1,000 of the population. The ratios of these unknown diseases varied in 1881 between 2·1 per 1,000 in Wun district and 11·4 in Bassim. The facts are their own best comment.

20. *Sanitary Works, Civil*.—Under this head is given a brief sketch, with tables, of sanitary improvements carried out in municipal towns and districts during 1881. The municipal towns are Amraoti, Akola, Khamgaon, Ellichpur, and Basim. The Municipal Act has been applied to another town, Shegaon, but had not come into operation. The aggregate population of the first five towns is 90,912, and their expenditure for sanitary purposes in 1881, stood as follows:—

					£
Conservancy	-	-	-	-	2,193
Drainage	-	-	-	-	137
Water-supply	-	-	-	-	254
					£2,584

or 6½d. per head.

Not much real work could be done for this sum, but it was nevertheless a quarter of the total income of these towns.

Amraoti is said to be fairly drained, but the drainage scheme remains to be completed. Cesspits still exist, which are cleansed periodically by municipal direction. A water-supply scheme is under consideration. Conservancy was less effective from falling off in supervision. Some repairs were made and ruined sites cleared. The death-rate of this town on a previous five years' average had been 21·3 per 1,000, and in 1881 it was 21·5, both rates apparently below the real rates.

The population of this town is 23,550. Public health can never be considered as properly cared for so long as cesspits and defective cleanliness exist in it.

Akola town has a population of 16,614. There is something radically bad in its sanitary condition, for its death-rate on a five years' average had been no less than 51·3 per 1,000. In 1881 the death-rate was 39·3, and this rate presented the anomaly of including 9·8 per 1,000 from cholera, and only 5·3 from fevers. It had, moreover, an unassigned death-rate from all other causes of 22·7 per 1,000.

This town has no drainage. But there is abundance of water from the river Morna, which has been improved in quality by filter wells.

Conservancy appears to be provided for, and the sweepings are sold for manure. Night-soil is collected by latrines, public and private, and removed for burial.

Diagnosis of death causes requires improvement in this town. Inquiry should be made into the causes of its very high death-rates. A survey of the town was being made for draining it, but apparently some examination of houses and compounds would reveal the reasons why so many die out of so small a population.

Khamgaon town has a population of 12,390, and a death-rate in 1881 of 31·6 per 1,000. Out of 392 deaths 90 were due to cholera.

The town was still undrained, although a drainage survey had been completed. Some masonry drains had been laid down. A water-supply scheme has been sanctioned, and waterworks were soon to be commenced.

Conservancy appears to be attended to, so far as outside surface cleanliness is concerned, but only one public latrine had been erected, which, however, had proved so complete a success that more were to be provided. Some wells have been repaired, and some new ones provided, but until house wells and cesspits are abolished, and the compounds kept clean, conservancy work will be partial and incomplete.

Ellichpur has a population of 26,782. Its five years' average death-rate has been 43·9 per 1,000, and in 1881 the rate was 29·8 in total absence of cholera. This town is undrained, and waste house drainage runs into *mories*, which are emptied occasionally.

Water is laid on to part of the town by pipes and hydrants, and the remainder is supplied from the river and wells. Water pipes and water distribution will, however, be extended all over the town when funds are available. But in this, as in all cases where special water-supply is brought into a town, it is absolutely necessary to provide drainage for its removal after use, otherwise added water will become in time an added disease cause. There is surface conservancy, but, so far as the houses are concerned, the latrines are not attended to by the municipality, and there are no public latrines.

This town requires its water-supply to be connected with its drainage, and, if possible, all the sewage should be applied to agriculture, house cesspits and house wells should be abolished, and the municipality should see to the cleansing of houses and compounds.

Basim.—Population, 11,576. This town yielded a five years average death-rate of 48·4 per 1,000, which had fallen in 1881 to 19·9 per 1,000, a somewhat doubtful figure. It is drained by side cuttings, into which house water runs, or it passes into cesspits. Conservancy of surface is provided for, but the whole place requires improvement in drainage, water-supply, and in houses.

21. Besides municipal towns, all villages with more than 5,000 inhabitants are classed as towns for registration purposes, and in the larger population groups more attention has been paid to sanitary work than in smaller villages. Excluding the municipal towns, a sum of about 10,926*l.* was allotted in 1881 for improvements in villages. Of this amount 1,700*l.* went to civil stations, 4,482*l.* to non-municipal towns, and 2,753*l.* to villages. Of the total amount spent in this way, 2,464*l.* went for conservancy, 1,158*l.* for drainage, and 3,016*l.* for water-supply. A list of above 350 items on which the money has been laid out is given in the report. These include local conservancy arrangements, improvements in wells, new wells, and water-supply, works of surface drainage, tree planting, &c.

Considering the smallness of funds, the list shows a large amount of useful work done in the course of the year; but, as the statistics show, much more work requires to be taken in hand.

22. Under the head of *general remarks* some information is given as to the condition of villages and village work. The native superintendents of vaccination continue to inspect villages on their vaccination tours, and the Sanitary Commissioner considers that these inspections have been of great utility, and have proved conducive to more careful registration of births and deaths. Every village patel has been furnished with a copy of village sanitary rules. "In some villages attention is paid to these, but in many they remain a dead letter." Dr. Cunningham's "Sanitary Primer" has been introduced into all schools, and distributed among vaccination officers. Water analysis has been carried out at Akola and Ellichpur, and the report concludes with an account of the sanitary state of a number of towns and villages which has brought to light the usual insanitary results of absence of proper drainage works, defective supervision of conservancy, doubtful water sources, and spending of money on certain objects which might have been better spent in other directions. For instance, in the case of Akola, there stands the following recommendation:—"To reduce the cost of the municipal office establishment, in order to provide funds for sanitary work." There also appears to be laxity in carrying out the existing sanitary law.

23. On these practical administrative points there are some useful remarks in the letter of Mr. Howell to the Secretary for Berar, and also in the proceedings of Government on this report. Mr. Howell calls pointed attention to the fact that, notwithstanding all the reporting which has taken place, there has been so little practical action on the part of municipal authorities. He says, "It seems also to be forgotten, especially in India, that reporting is not an end, but a means to an end, and this end is work actually done or to be done." We are afraid that this censure is pretty generally applicable. If the sanitary executive had been as active as the sanitary reporting officer, improvements would have proceeded at a very different rate than they have done. Mr. Howell meets the customary excuse of poverty in the following words, which every executive sanitary authority in India should bear in mind:—"The excuse for this neglect is want of funds, which, if it were true, is invalid, because it is the business of municipalities to raise funds for the primary and essential purpose of sanitation;" and he goes on to show that a proper system of sewage trenching may not only be self-supporting but remunerative, and that it is most important that the towns should place themselves in such a position as to sanitary work, that they might afford examples to be followed by country people visiting them.

24. As to the villages themselves, there is a passage in the Government resolution which appears to us to be of much practical importance, and we may quote it. Mr. Trevor, the Secretary, says, "If Government officers made it a rule to make the patel of every village they pass through, or encamp at, produce his sanitary code, and to ascertain how far it had been acted up to, the idea that sanitation is an object of real anxiety to Government would soon spread, and cases such as Dr. Little refers to, when patels forget that they have codes, would be unknown."

25. These two official statements sum up the practical results of Dr. Little's very interesting report, and we have only, in conclusion, to express our concurrence in the principles they enunciate, and our hope that the sanitary administration may be so systematized in both towns and villages that the mere reported fact of the existence of removable insanitary conditions may lead to their being at once dealt with. After so many years of reporting, fresh complaints become of the nature of indictments against all persons entrusted with local powers for improving public health.

13th June 1883.

No. 9.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for ASSAM for 1881.

1. The census population of Assam for 1881 amounted to 4,815,157. But excluding the hill districts into which registration has not as yet been introduced, the eight districts furnishing returns of some kind contained at the date of the 1881 census a population of 4,483,705 affording an increase during the preceding ten years of 679,489. If both enumerations were trustworthy, the law of increase would be for the entire population about 1·9 per 1,000 per annum, a result rather proving that the population of 1871 had been in all probability under-estimated, at least when we take into account the sanitary condition of the population which presents itself in the present and in preceding reports for the province.

2. The population furnishing vital statistics in 1881 is thus not the total population of the province, but that of the following eight districts, six of which have also in this the first year of the new decade supplied births as well as deaths:—

Districts.	Population, 1881.	Births.		Deaths.	
		Total.	Per 1,000.	Total.	Per 1,000.
Goálpára - - - - -	446,232	6,143	13·77	5,855	13·12
Kámrúp - - - - -	644,960	11,180	17·33	9,614	14·91
Nowgong - - - - -	310,579	8,602	27·69	7,863	23·71
Darrang - - - - -	273,333	5,270	19·28	5,585	20·43
Sibsagar - - - - -	370,274	9,334	25·20	7,315	19·48
Lakhimpur - - - - -	179,893	2,204	12·25	2,044	11·36
Sylhet - - - - -	1,969,009	—	—	32,274	16·39
Cachar - - - - -	289,425	—	—	1,991	6·87
Total - - - - -	4,483,705	42,733	19·20	71,941	16·04

The deaths amounted to 71,941, equal to a death-rate for the whole population under registration (namely 4,483,705) of 16·04 per 1,000. But the 42,733 births and their ratio of 19·20 per 1,000 were derived from a population of 2,225,271, or a little more than one half of the population yielding the deaths. The death-rate and birth-rate taken over the population yielding both ratios in 1881 were:—

	Per 1,000.
Births - - - - -	19·20
Deaths - - - - -	16·93

or between two and three per 1,000 increase of births in the year over the year's deaths.

The registration is improving, and further steps were being taken in this direction at the close of the year.

3. The following numbers of deaths were registered under the usual heads in 1881:—

	Deaths.
Cholera - - - - -	5,010
Small-pox - - - - -	3,129
Fevers - - - - -	42,553
Bowel complaints - - - - -	9,865
Injuries - - - - -	934
All other causes - - - - -	10,450
All causes - - - - -	71,941

With the exception of diseases classed as "bowel complaints," there was a large increase of mortality under all the headings, while the total deaths exceeded by 20,275 those registered in 1880; but this fact indicates better record, and not necessarily increased death-rate.

4. There was little special in the year's disease history, as the following brief summary will show:—

Cholera.—The death-rate from cholera was 1·12 per 1,000 of the total population: mortality from cholera was highest in low lying, wet, and damp districts on both sides of the Bramahputra river. The Sanitary Commissioner has given an excellent map of Assam, on which the relative prevalence of cholera is shown by colours, and from this it appears that all districts within which the cholera mortality was at or above one per 1,000 were riverside districts, and that elsewhere the rates were about one half this amount.

Cholera deaths were reported from 201 out of 389 circles of registration, and from 620 villages out of 17,355. But the number of the attacked villages does not include those in Sylhet, so that excluding all the Sylhet villages, of which there are 6,380, there would remain 10,975 villages, in 620 of which there were 3,554 cholera deaths.

The facts afford an additional illustration of an established law of epidemic cholera in India namely, that whether the disease covers a larger or smaller area of country, the attacks are strictly local, pointing directly to the need of local sanitary measures.

In the districts for which data were available, the proportion of attacked villages was about 5·6 per cent., but in the three most severely affected of these districts, Kamrup, Nowgong, and Sibsagar, the proportion of villages which suffered rose to 8 per cent., affording another illustration of a great general law of epidemic cholera, that its death-rate depends in most cases on the number of points attacked.

5. There was a great difference in cholera mortality among the district and town populations. In the former the census enumeration gave 4,425,692 inhabitants, among which there were 4,716 cholera deaths, equal to a death-rate of 1·07 per 1,000. In eight Sadr towns there were 294 deaths from cholera out of a conjoint population of 58,013, affording a death-rate of 5·07 per 1,000. Of these towns, Gauhati, with a population of 11,695, yielded 216 cholera deaths, or 18·47 per 1,000, the highest local rate of the year.

6. The cholera invasion of the two great valleys of Assam presented the following striking seasonal differences :—

Months.	Registered Cholera Deaths.	
	Brahmaputra.	Surma.
January - - - -	74	496
February - - - -	20	131
March - - - -	10	173
April - - - -	74	282
May - - - -	113	176
June - - - -	398	16
July - - - -	440	53
August - - - -	418	62
September - - - -	322	9
October - - - -	485	5
November - - - -	655	4
December - - - -	540	54

There were apparently two distinct and separate epidemics in these valleys, having no relation to each other. There is too little information available on the comparative meteorology of these districts to enable the influence of this important element to be arrived at. But the following remarks of the civil surgeon on cholera in Sylhet, included in the second column of the abstract, are important. He says, "Looking back to my notes for the last six years, I find it has invariably happened that as soon as the country becomes dry cholera makes its appearance, and remains till the inundations set in." He explains that during the rains "the district is practically converted into an archipelago, and epidemic cholera is rarely heard of." But, "with the dry season come reports of cholera from every direction. They are almost simultaneous from every point of the compass. It springs up like a plant of the season. Its progress," he says, "cannot be mapped out and traced from place to place, like a cholera epidemic in the North-west provinces."

We have here then perfectly trustworthy evidence that there is a large district of Eastern Bengal subject to high rainfall and to flooding where cholera cannot exist so long as the flooding continues, and it follows that exposed earth surface and local climatic influences are necessary conditions to the appearance of cholera, and that this is a different matter altogether from moving cholera, and the losses occasioned by it. But the facts suggest a whole line of inquiry as to whether the appearance of cholera at successive points up the Ganges valley is not coexistent with conditions of surface and subsoils favourable to its appearance, which reproduce at successive points away to the north-west the conditions necessary to the existence of the disease as the season and climate advance, rather than actual movement of the epidemic?

This is simply made as a suggestion, which, if found to be true, would throw light on some obscure parts of cholera history, and reduce its complicated phenomena under the same law which governs its origin in what is called the "endemic area."

7. A table is given in the report to show the relation between rainfall and cholera in five thanas, including Nowgong, where the rain was registered, of which the following are the monthly totals :—

Months.	Rainfall at Nowgong. Inches.	Deaths from Cholera.
January - - - -	0·06	41
February - - - -	0·64	6
March - - - -	3·12	5
April - - - -	5·42	15
May - - - -	6·95	4
June - - - -	18·35	122
July - - - -	18·89	217
August - - - -	15·49	78
September - - - -	13·38	54
October - - - -	0·61	18
November - - - -	0·05	140
December - - - -	—	20

Rainfall generally influences the amount of cholera in a district at dates subsequent to increase or decrease in amount of rain, and the fact can be best shown in monthly divisions, rather than by quarters of years, which tend to obscure the relation between the events. Taken on the quarters, as has been done in the Report, the relation between rainfall and cholera is not very evident, but, as the preceding abstract shows, low rainfall is followed (not accompanied) by great increase of cholera mortality, while high rainfall is followed by decrease of deaths, which again increase after falling off of rain. We suggested long ago the use of a daily register of rainfall, and cholera mortality which would afford the most accurate means of comparison.

8. But whatever may be the influence of flooding and subsequent water subsidence on the outbreak of cholera, in certain districts of Assam, or of rainfall on its monthly history, the present Report, although not professing to give a sanitary account of affected localities, nevertheless contains information to show that local causes, with which alone it is possible to grapple, played a very important part in augmenting the death-rates. For example, it is stated of one thana, Roha, "that the people live surrounded by every conceivable insanitary condition. Their huts are low and damp and badly ventilated, and often so densely surrounded by jungle as to exclude both air and sun. Refuse matter of every description rots near their dwellings, and their water-supply, which probably never pure, is not unfrequently directly fouled and polluted."

The Civil Surgeon states that no precautions are taken when cholera appears, and that the same condition of things existed in nearly all the villages he visited.

Local damp or wet ground, local filth and its consequences, foul well and tank water, appear to be the principal determining causes of cholera in Assam. Death still takes place from it among coolies in the tea gardens, but there are no statistics available as yet for these establishments. The Medical Officer states, however, that the coolies are now provided with better water, and more comfortable houses. But, "except on tea gardens, no changes likely to prevent an outbreak of cholera or lessen its severity have been made. The villages are filthy in the extreme, and in many of them there is no water except that obtained from drains and shallow mud wells, so that when next we have an epidemic we may expect a repetition of 1879."

9. We are glad to see that the Deputy Commissioner has requested that the Civil Surgeon should visit the larger villages and examine into their sanitary state, in order that any suggestions he might make might be carried into effect by the Deputy Commissioner.

This is a very important matter, but it must be borne in mind that, so far as local epidemic causes are concerned, "the cholera water theory," which has done not a little to prevent the progress of sanitary work, does not cover all the ground even in the flooded regions of Assam. The fundamental cause of cholera, so far as concerns locality, is filth, without which, no foul water could exist even in Assam, and no remedy would be found for this filth, even if none but distilled water were given to the people. Provision of better water, or rather the protection of water sources from surface and subsoil filth, is a matter of urgent necessity, and, must form an essential element in the sanitary improvement of every Assam town and village. We have shown how this can be done in our "Suggestions," but it would be an unfortunate mistake to leave out the drainer and scavenger from the work. All this is better understood now than it was a few years ago, when a short road to the management and prevention of cholera was sought in this water theory.

10. *Small-pox.*—As already stated, small-pox deaths during 1881 numbered 3,129, of which only 47 took place in the Sadr towns, equal to a death-rate on their population of .81 per 1,000. The rate for the whole population was .69 per 1,000. The following were the monthly deaths :—

Months.	Small-pox deaths.	Months.	Small-pox deaths.
January - - -	154	July - - -	365
February - - -	202	August - - -	285
March - - -	316	September - - -	203
April - - -	474	October - - -	137
May - - -	297	November - - -	162
June - - -	349	December - - -	185

The relation of these deaths to temperature is shown by the observation, that the highest daily mean temperature beginning with 70·13° F. in April, and rising to 87·14° F. in July, and thence to 83·43° F. in September, included the period of highest small-pox mortality. The coincidence is generally observed in India, and appears to point to climatic elements as among predisposing causes of small-pox there.

Inoculation is stated to be still a common practice and a cause of extension of small-pox. There are no means of accurately comparing small-pox deaths with vaccination operations, as the vaccination report is separately published, and besides the Chief Commissioner in his review points out that the sanitary and vaccination reports "are not synchronous, but relate one to the calendar, the other to the official year," an anomaly which may advantageously be corrected.

If, however, we take the data in the vaccination report for 1881-82 as they stand, and compare them with the small-pox mortality of 1881, we arrive at the following results, beginning with the vaccination staff :—

Civil Surgeons	-	-	-	-	12
Hospital assistants	-	-	-	-	34
Vaccinators	-	-	-	-	31
„ municipal	-	-	-	-	5
Ex-inoculators	-	-	-	-	96
Total	-	-	-	-	178

Primary vaccinations	-	-	-	-	39,128
Of these successful	-	-	-	-	34,698
Successful re-vaccinations	-	-	-	-	1,118
Total successful operations	-	-	-	-	35,816

Small-pox deaths 1881	-	-	-	-	3,129
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11. *Fevers*.—Deaths from “fevers,” 42,553 in number, represented a death-rate for the entire province of 9·49 per 1,000, probably under the truth. The lowest registered rate was 4·32 per 1,000 in Cachar; the highest 14·39 per 1,000, was registered in Darrang. Taken separately, the country rate was 9·51 per 1,000, and the town-rate 7·76 per 1,000. When compared with other regions of India, the fever death-rate of Assam is not high. The following abstract shows the monthly incidence of fever during 1881 :—

Months.	Fever deaths.	Months.	Fever deaths.
January - - -	3,053	July - - -	3,590
February - - -	2,465	August - - -	3,235
March - - -	2,488	September - - -	3,567
April - - -	2,515	October - - -	4,508
May - - -	2,920	November - - -	5,272
June - - -	3,178	December - - -	5,772
Six months -	16,614	Six months -	25,939

The months of lowest fever mortality were February, March, April, and May, which together yielded 10,383 deaths, or a fourth part of the mortality.

The remaining three-fourths took place in months which had climatic peculiarities connected with heat and rainfall, and with sudden falls of temperature and the occurrence of fogs.

Excess of moisture, or rather of water, appears to be unfavourable to the production of fever. The Civil Surgeon at Lakhimpur states that such is the case in his district, and that fevers are of intermittent type chiefly, and usually tractable.

Remittent is comparatively rare, but enlarged spleen and malarial cachexy occur. In Goalpara district there is a tract of country on the north bank of the Brahmaputra where the Deputy Commissioner states “there is hardly a single inhabitant, and it is said that this tract has been “depopulated by malaria.” Fevers in this district are most fatal at the base of the Garo Hills. In Nowgong district, where the fever death-rate averaged 12·66 per 1,000, the last three months of the year showed the greatest mortality, which, the Civil Surgeon reports “is easily accounted for by the “fact of heat and wet acting on heaps of filth collected in villages and producing poisonous vapours, “the influences of which the people in an already enfeebled state are unable to withstand.”

There is nothing unusual in the fact of this year’s experience of Assam fevers. They all tend to show that village improvements in water-supply, drainage, cleansing and jungle clearing, will have to be carried out, before we can expect reduction in fever death-rates.

12. *Bowel complaints* caused 9,865 deaths, or 2·20 per 1,000 of the population. The highest recorded death-rate was in Sibsagar district, namely, 4·21 per 1,000. Although the nomenclature and registration are still defective, the monthly deaths under this head, chiefly diarrhoea and dysentery, present the following features, which are well worth inquiry :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	663	July - - -	768
February - - -	475	August - - -	677
March - - -	438	September - - -	957
April - - -	544	October - - -	1,184
May - - -	802	November - - -	1,241
June - - -	806	December - - -	1,310

It will be observed that the death-rates follow no regular course in the first eight months of the year, but that a rapid rise occurs on and after September.

The rates differ greatly also in different parts of the country. Sibsagar, as already stated, yields the highest rate, and it appears to be persistent, pointing to some special causes in the localities.

The lowest bowel complaint death-rate, '57 per 1,000, took place in Cachar.

13. *Injuries*.—In the year 1881 there were 74 deaths from suicide, 670 from wounding and accident, and 250 from snake-bite and wild beasts. There is nothing in the facts calling for special remark, so far as practical remedies may be required, for the details are not given.

14. The only matter in the section on disease history which appears to call for remark is the following passage, which may be noticed, not for the purpose of interfering with the individual opinions of the Sanitary Commissioner, but simply to state that such views are unnecessary in sanitary reports made in the public service:—"For, though epidemic disease requires a special contagium to produce it, surrounding conditions must have a potent influence in its development. Over the production of contagia, or the special viruses of disease and the influences of the weather, we have no control, but we have complete control over the insanitary conditions in which people live, and experience has abundantly shown us that, under the presence of the contagium of an epidemic, a foul atmosphere, bad drainage, cesspools, and putrefying refuse matter may push that contagium into the virulent energy of reproduction. These conditions, then, are all removeable causes, but too frequently they become the potent distributors of disease and death. Our immediate and earnest attention is required to one common remedy, namely, to general and more efficient conservancy of the soil, air, and water in every town, and, as far as possible, in the larger villages in this province. The early removal of putrefactive matter from around and from within dwelling-houses before it can split up into foul and unwholesome gases, the supply of a pure and unpolluted water for domestic purposes, the clearing of dense jungle and undergrowth from around the houses of rural and urban communities, more efficient drainage, better constructed houses, with the view of teaching the people to sleep off, and not on, the damp floors of their cottages—the cottage or hut itself should be raised on piles."

We have often advised the adoption of these improvements, and we entirely concur with the Sanitary Commissioner as to the practical conclusions at which he has arrived, but we cannot see how their necessity is made more evident by introducing "contagia" into his very clear and useful summary of work which must be done. If this speculative matter is introduced at all, it must lead logically to far other measures than these. It follows that, in the present state of our knowledge, it is better to keep clear of hypothetical disease causes, and to limit our work strictly to practical inquiry and observation, and, by doing so, we shall avoid another not unfrequent error of ascribing an epidemic or endemic seizure to a solitary speculative cause, where observation showed that the causes were many. At all events, there ought to be no difficulty in acting on the principle that, whether disease "germs" exist or not, the practical work must be done.

15. Under Section IX. (Sanitary Works, Civil) a brief statement of improvements carried out in 12 towns, unions, &c., is given, but the expenditure has only been returned from 10 of them. The total amount expended for all public health purposes, including roads and medical relief, in these 10 localities, was 3,769*l.*, of which 583*l.* was for drainage, 166*l.* for water supply, 854*l.* for conservancy, and 1,778*l.* for roads and conservancy. Not much in the way of sanitary work could have been done for this sum, and the notes on the localities themselves show this to have been the case. Sanitary work is only being begun in Assam.

16. Under the head of "General Remarks" the Sanitary Commissioner states that, of 8,213 coolies embarked at Dhubri for the Brahmaputra voyage, two died of cholera and 12 from other causes. The death-rate for the voyages, the average duration of which is not stated, would thus be 1·7 per 1,000, showing that disease causes which were in operation in previous years had diminished in intensity. There was, in fact, less cholera than usual, and the Sanitary Commissioner adds a caution "that, while this report is being written, there is already a foreshadowing of outbreaks of cholera as severe as those experienced in previous years." We have had occasion, in several of our previous memoranda, to deal with these river outbreaks among coolies, to whom they were almost entirely confined. They were attributed at first to bad drinking water, but this has been corrected. It has not been shown that cholera on these voyages has been due to exposure or to bad diet, or to local infection, although cholera often exists as an endemic on both sides of the river. The only remaining cause apparently is the one we have discussed in previous memoranda, namely, that the coolies bring cholera predisposition on board with them, to be developed into activity by conditions on board ship. If this view be correct, the cause must be traced back, as we formerly pointed out, to the depôts, and it is possible that careful medical inquiry might show that cholera cases had been embarked in the diarrhoeal stage. At all events great care requires to be exercised over the sanitary condition of the depôts and the surrounding localities. The health condition of coolies at the port of embarkation is reported as exceedingly good, but this does not preclude the possibility of predisposed cholera cases being put on board.

17. It is satisfactory to learn that the sanitary management of the tea gardens is being improved. This is stated on the personal testimony of the Sanitary Commissioner as follows:—"I visited many tea gardens in Upper Assam, that is beyond Dibrugarh, on the line to Sadiya, and I was much pleased with the general care which I saw bestowed on tea garden coolies, especially in several instances on the weakly and sick. The general hutting of the coolies, the water-supply in many of the tea gardens, showed marked signs of improvement, and on many of the better class of gardens I met with indisputable evidence of the kindly treatment bestowed by managers themselves

"on the tea gardens' labourer. . . . That an unmistakable movement forwards, towards the "improvement of the health status of the garden coolie throughout Assam has been made during the "past few years there can, I think, be no doubt." This experience is confirmed by other reporters. More attention has been paid during the last two or three years to hutting, drainage of lines, providing good water, and more suitable diet, cleanliness, and the cultivation of fruits and vegetables; but still from one district, Cachar, we have the following startling fact that "on only two gardens in "1880 was there a mortality over seven per cent.," which, be it observed, is the death-rate of a great pestilence. No doubt there has been improvement even in Cachar, but it would be a matter of no small interest for sanitary purposes if we could be informed of what nature was the management which rendered such a death-rate possible. Unfortunately, there are no statistics regarding these rates, and, until the true figures are supplied to the Sanitary Commissioner, no reliable opinion, either as regards causes or remedies, can be given.

18. During the year the Sanitary Commissioner made numerous inspections in both of the great valleys of Assam, and his tour extended over 2,127 miles by land and water. He again refers to the interruption of his work, by having been called away by the Commander-in-Chief in his capacity of head of the Military Medical Service. No doubt this is one of the disadvantages of the late changes, but it may be possible to obviate any injury to the civil branch by a little arrangement made beforehand.

19. Appendix A, on the utility of *amchur* as an anti-scorbutic, and the appendix on dispensaries, belong to administrative matters. The first comes under the Medical Department, and Sir A. Home has advised that a twelve-month's trial be given to the remedy among Native troops. The dispensary administration is not within our province.

20. In conclusion, the present report should be considered as a continuation of the report of 1880. The two together give a good general idea of the Assam sanitary problem, which is made up of several elements.

The climate is a wet or damp one, with seasonal fogs. The ground and subsoils are wet, and subject to water-logging or flooding. Evidence appears to show that the very excess of water in the low flat districts of the valleys is, to a certain extent, unfavourable to the rise of epidemics, but that the dry or drying-up season is the period of greatest epidemic prevalence.

But, besides these unalterable conditions, there are abundant local disease causes due to the habits of the people themselves, and it is to these and their eradication that sanitary effort may in the meantime be most effectually directed. They have been so well summed up by the Sanitary Commissioner that it is unnecessary to do more than advise strongly that the practical examinations of villages directed by the Chief Commissioner should be efficiently made, and local schemes for their improvement drawn up and carried out. A further important step in sanitary progress would be to try the introduction into Assam of the Burmese practice of building houses on piles. It is satisfactory to learn that sanitary improvements have been introduced into the tea gardens; but some steps should be taken with those gardens where such excessive rates have prevailed as are stated in this report. It would be for the benefit of all parties that such rates should be improved off the face of the earth.

In our suggestions for the sanitary improvement of India stations and their vicinity, we have laid down the principles on which village and town improvements should be carried out.

12th June 1883.

No. 10.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the SANITARY COMMISSIONER for BRITISH BURMA for 1881.

1. The total population of British Burma, according to the census enumeration of 1881, is given by the Chief Commissioner as 3,736,771, being 29,125 in excess of the number adopted in our memorandum on the report for 1880. In certain remote and comparatively inaccessible hill tracts registration has not yet been attempted, and leaving out the population of these districts, there remains a population in which registration is more or less successfully effected of 3,692,263, including—

Males	-	-	-	-	1,968,029
Females	-	-	-	-	1,724,234

2. The registered births on these numbers in 1881 were—

Males	-	-	-	-	38,012
Females	-	-	-	-	35,742
Total	-	-	-	-	<u>73,754</u>

The total registered birth-rate was 19·98 per 1,000 of the population, a ratio considerably under the truth, as is shown by the fact that birth-rates in districts vary between 13·55 and 33·18 per 1,000.

3. In the same population the deaths were, of—

Males -	-	-	-	-	31,966
Females	-	-	-	-	26,170
Total	-	-	-	-	58,136

yielding a death-rate of 15·75 per 1,000. The death-rates, like the birth-rates, varied in different districts between 8·88 per 1,000 and 28·20 per 1,000.

Registration has been attended with considerable difficulty, and even in its present defective state it is the result of much work. The ratios, such as they are, give little useful information, but there is no help for this defect except in time and persistent effort.

Registration of deaths is much better carried out in towns than in country districts. The average death-rate of 1881, taken over a population of 414,529 living in 18 towns, was 27·43 per 1,000, the ratios lying between 14·36 per 1,000 (very nearly the district average), which was the lowest registered rate, and 48·76 per 1,000, which was the highest. These contrasted facts would appear to show that, with suitable registration machinery, it might be possible to arrive at better district results.

4. *Causes of death.*—Where the general registration has shown these defects, not much reliance can be placed on diagnosis of death causes, or in the proportion of deaths assigned to each cause. Such as they are, the facts are as follows:—

Diseases.	Total Deaths.	Deaths per 1,000 of Population.
Cholera - - -	5,239	1·42
Small-pox - - -	1,766	0·48
Fevers - - -	27,743	7·51
Bowel complaints - - -	3,808	1·03
Injuries - - -	523	0·14
All other causes - - -	19,057	5·16
Total - - -	58,136	15·75

We shall discuss briefly the year's disease history under each of these heads.

5. *Cholera.*—Cholera death-rates were apportioned between town and country populations in the following ratios:—Towns, with their population of 414,529, yielded 658 deaths, equal to 1·57 per 1,000 of the population, while the country deaths, among a population of 3,277,734, were 4,581, affording a cholera death-rate of 1·40 per 1,000. Two of the towns, Mergui and Toungoo, escaped cholera, while two of the districts in Arakan division also escaped. There was a very general diffusion of the disease in 1881, but the attacks were confined to 97 circles of registration out of 875 in the provinces, and all the deaths were returned from 222 villages out of a total of 15,451.

The following abstract gives the monthly incidence of cholera in 1881:—

Months.	Cholera Deaths.	Months.	Cholera Deaths.
January - - -	417	July - - -	1,452
February - - -	139	August - - -	1,634
March - - -	105	September - - -	212
April - - -	226	October - - -	61
May - - -	346	November - - -	69
June - - -	285	December - - -	293

The figures in this table cannot be well understood without reference to the corresponding data for 1880, which were as follows:—In that year there were two outbursts of cholera, and the maximum number of deaths during the first of these was in January, and amounted to 163. The mortality then declined rapidly, until in August only one death took place. But in the next four months the deaths were 91, 602, 887, and 634 in December, from which month of 1880 the epidemic passed over to January 1881, which yielded 417 deaths as already shown, and the subsequent history of cholera during the latter year is given in the table.

6. The intensity of cholera varied greatly in different divisions of Burma. For example, in the three districts of Arakan, out of 3,335 population groups only five in Akyab district yielded 18 cholera deaths. The death-rate for Akyab was 0·05 per 1,000, while its previous five years' average rate had been 6·78 per 1,000. The highest district death-rate of the year was that for Thayet-Myo, which reached 7· per 1,000. Generally the river-side divisions yielded the highest rates. The town of Thyet-Myo itself yielded a death-rate of 4·78 per 1,000, while the rural part of the district had a rate of 7·34 per 1,000. On the other hand the towns of Yandown and Pantanaw had cholera rates of 6·79 and 7·29 per 1,000, while the rate of Thonegwa, the country within which they are situated, was only 1·39 per 1,000.

Rangoon, the capital city, with a population of 134,176, had only 72 cholera deaths, or 0·54 per 1,000

7. A new year has removed from Burma a newly-appointed Sanitary Commissioner, who has been replaced by another newly-appointed officer, and it is probably to this cause it is due that no sanitary account of cholera is given in the present year's report. It affords another instance of the disadvantages attending frequent changes in the sanitary administration under recent arrangements, which ought to be met by some better apportionment of duties. We feel assured that when Government sanctioned the union of medical and sanitary duties under one inspecting officer, no such result was contemplated.

8. That there may have been localizing causes sufficient to account for much of the loss of life from cholera had they been looked for, may be inferred from the following facts about Dala, in Rangoon, detailed by the Civil Surgeon, who states as follows:—"In the course of an inquiry into the cause of the epidemic at Dala, and the influence of neglected sanitation, and foul wells, tanks, and streams on the health of the adjacent population, it was found that that influence is everywhere concealed by the presence of nuisances of a much more obvious and decided nature. Among these there is one nearly universal, the injurious effect of which overpowers that of all others, viz., the retention of house refuse, and every abomination in the way of filth, close to, and indeed sometimes underneath, their dwellings. The condition into which the systematic retention of such filth brings the whole of that part of Dala occupied by the poorer classes is probably not generally known. . . . In one group of houses, when cholera prevailed, the water was got from a filthy tank and a dirty stream close by. The waste water is thrown in front of the house, or oftener through the bamboo flooring of their huts to the ground beneath; a fluid, several inches deep, accumulates; into this are thrown all sorts of house refuse, possibly sometimes excreta and urine, with which is at length formed a semi-fluid mass of putrifying animal and vegetable matters, disgusting in appearance, and giving off a most offensive smell. Of the very large numbers thus seen, not one was found in a satisfactory condition, but the description above given, with slight modification, sometimes a little for the better and sometimes for the worse, would apply nearly to the whole of them."

Of course, with such a state of matters at Dala or anywhere else, one would expect cholera when an epidemic was about. It is a solitary example given of the year's experience, and we must make the best of it by asking why such a thing is allowed to exist. Somebody must be to blame for it. First afford to the people facilities for keeping their houses, water sources, and surroundings clean, and then see that they do it. This is the simple practicable rule to be applied in this and similar cases.

9. The Sanitary Commissioner mentions another outbreak of cholera which took place between 18th November and the 1st December in the lunatic asylum, appearing and disappearing suddenly, and he asks, "If the outbreak at Dala was the result of deficient sanitation, or rather no sanitation whatever, what shall we say to this epidemic which suddenly broke out in one of the best cared for institutions in Rangoon? The lunatic asylum is kept scrupulously clean, the latrines are in the most perfect order, and the inmates kept in seclusion from the outer world, and yet here cholera suddenly makes its appearance and as suddenly ceases."

The reply, so far as facts enable a reply to be given, may be as follows:—When an epidemic of cholera is in a district within which lunatics are kept, these, partly from the necessary restrictions under which they are placed, are liable to cholera, and, in some cases, the only remedy might be found in their removal. And admitting this liability, which apparently exists, it by no means follows that the sanitary state of the asylum as described above would be sufficient protection to its inmates. Large space, free circulation of air, pure water, suitable food and clothing, all enter within the domain of preventive measures in asylums, as well as cleanliness, and what would be sufficient in these matters in ordinary times would not necessarily be so when an asylum was in the midst of an epidemic.

10. We shall conclude this statement about cholera with the following facts, to show the necessity for dealing with the disease on distinct practical principles. The Sanitary Commissioner says:—"A most extensive and fatal epidemic of cholera prevailed in the town and district of Thyet-Myo from the end of April to the close of the year. The total number of deaths in the town was 95, and in the district 1,234 died." Surely here was a case in which the local medical authorities ought to have given some information as to the localising causes of the pestilence, and what was done for them. This is what is said about it:—"There is no evidence to prove the disease was imported, but there is every likelihood of this being the case." Where was it imported from, and why was it there to be imported? Is it too much to ask that loose opinions of this kind should be avoided in sanitary reports, which are of no use unless they form the basis of practical action.

11. *Small-pox*.—In 1880 there were 5,402 registered deaths from small-pox, while in the year under review the mortality had fallen to 1,766. There has been a reduction of small-pox mortality from a previous five years' death-rate of 1.01 per 1,000 to 0.48 per 1,000 in 1881. This disease was very generally diffused over the province in 1881. Deaths from it were returned from all the 15 districts; with two exceptions, both in Tenasserim division. But the disease showed its presence only in limited areas within the districts, for out of 848 registration circles in 13 affected districts only 64 were attacked. In the same 13 circles are 14,960 villages, and all the deaths were returned from 87 of these. Small-pox in 1881 was endemic, and showed little tendency to diffuse itself over the adjacent country. The highest district death-rate was in Henzada, which yielded a ratio of 1.51 per 1,000. Out of 18 towns 12 yielded deaths. The highest rate was that of Kyangin, 11.37 per 1,000. Generally the town death-rate exceeded the country rate in the proportion of 1.33 to 0.37

per 1,000. Of the total deaths, 1,766 in number, 1,027 were registered in males and 739 in females. There were 342 deaths in infants under one year of age, and above half the year's mortality took place at ages under 12.

12. It is not easy to give a connected history of small-pox in a country having such various climatic and topographical conditions as Burma, and in the present state of registration, because all the factors are not in our possession. Using such information as we have, we find that in the first eight months of 1880 there were 5,027 small-pox deaths registered, and in the last four months only 375. The months of highest mortality were March and April, and the deaths in October had fallen to 61. In November 68 small-pox deaths were registered, and there was a sudden increase to 150 deaths in December 1880, passing onwards into 1881, as is shown by the following abstract, which gives the monthly incidence of small-pox during the latter year:—

Months.	Small-pox Deaths, 1881.	Months.	Small-pox Deaths, 1881.
January - - -	224	July - - -	96
February - - -	330	August - - -	52
March - - -	368	September - - -	53
April - - -	315	October - - -	8
May - - -	145	November - - -	16
June - - -	107	December - - -	52

These monthly numbers for the whole province represent approximately the monthly ratios in different divisions. So far as can be judged of, small-pox in Burma declines in autumn to increase in winter, and to attain its maximum in spring.

13. The vaccination establishment for the official year 1881-82 was made of—

Superintendent General	-	-	-	-	1
Superintendents of circles	-	-	-	-	16
Superintendents of circles, Native	-	-	-	-	3
1st class vaccinators	-	-	-	-	16
2nd class vaccinators	-	-	-	-	29
Servants	-	-	-	-	2
Total	-	-	-	-	67

The year's work consisted of 39,844 successful vaccinations and re-vaccinations. 11 per 1,000 of the population were successfully vaccinated, and 0.48 per 1,000 died of small-pox.

But against 39,844 successful vaccinations must be placed 73,754 registered births, or 19.98 per 1,000. The first figure must be accepted as correct, the last represents about half probably of the real births. Any way the figures show how large an extent of ground must be covered by the vaccinators before the births are dealt with, leaving out the unvaccinated adult population. The average cost of each successful vaccination was 8 a. 5 p. The total establishment charges were 2,1087.

14. *Fevers.*—The same difficulty exists in Burma as in India in the diagnosis of death causes usually attributed to fevers. The Sanitary Commissioner states that the "Burmese call all illnesses in " which there is an elevated temperature of the body by the common name of fever," while medical officers concur in opinion that Burmah is not specially a malarial country. Dispensary returns for 1881 give the outdoor and indoor patients for that year at 121,798, and of this number ague and remittent fevers yielded 18,632, or a little over 15 per cent. But taken on the febrile group this proportion is much higher, for besides true malarial fevers, about which there could be no doubt as they were seen at the time, there were admitted 148 cases of small-pox, 136 of cholera, and 299 of all other febrile diseases. There were, however, 4,095 rheumatic cases, which might come under febrile conditions in their course, but any way there was a large number of purely malarial fevers treated. We concur in opinion, however, with the Sanitary Commissioner that some simple means might be tried to separate true fever deaths, and perhaps the method he suggests of adopting paroxysmal symptoms as tests in place of the heat test might help to solve the difficulty.

15. There were, as has been already shown, 27,743 registered fever deaths, or 7.51 per 1,000 of the population against a previous five years' annual average of 9.07 per 1,000. Fever deaths were registered in all the 15 districts of the province, and in 564 out of 875 registration circles, but only in 1,436 villages out of 15,451, or under 10 per cent. This single fact throws doubt on the whole fever question, and shows that there are either too many or too few deaths registered from this presumed cause. We can only deal with such data on the subject as the report contains, and the following table gives a monthly abstract of fever deaths.

Months.	Fever Deaths.	Months.	Fever Deaths.
January - - -	2,617	July - - -	2,656
February - - -	2,290	August - - -	2,915
March - - -	1,933	September - - -	2,679
April - - -	1,991	October - - -	2,327
May - - -	1,812	November - - -	2,186
June - - -	2,226	December - - -	2,111

This abstract, when compared with similar Indian tables, would appear to show that these Burmese data afford rather a fair monthly average registration under the fever head, than the monthly mortality from a class of diseases peculiarly influenced by season and climate. The registered fever death-rate for country areas was 7·28, and for towns 9·31 per 1,000.

16. On the assumption that death registration in Hanthawaddy district, within which Rangoon town is situated, is fairly accurate, we have the means of comparing the fever deaths within this district with rainfall and humidity as registered at Rangoon, but unfortunately the temperature maxima, minima, and ranges are not given, only the means. The following are the data :—

Months.	Fever Deaths.	Rainfall Inches.	Humidity.
January - - - -	328	—	50
February - - - -	327	—	44
March - - - -	289	—	48
April - - - -	245	—	51
May - - - -	188	14·17	74
June - - - -	223	17·23	89
July - - - -	272	30·30	89
August - - - -	288	17·72	90
September - - - -	280	15·17	85
October - - - -	259	4·21	83
November - - - -	238	2·99	71
December - - - -	285	0·08	74

It cannot be said that in the district of Hanthawaddy there is much apparent relation between rainfall and fever. The monthly fever deaths appear to point to the action of constant topographical causes. In a former memorandum we suggested that an inquiry might be made into the relation of subsoil water and fever prevalence at Rangoon, with the view of obtaining some information as to the reasons of those great diversities in fever death-rates which prevail over different Indian river deltas. In the Irrawaddy delta water is found at depths from 6 to 17 feet, and usually below water level in the river. The subsoil is usually sand, with bands of clay and laterite intersecting it, and there is no evidence that the subsoil water flows in the direction of the river. It may be stated in this connexion that the last five years' average death-rate from fever in Hanthawaddy district was 8·66 per 1,000. It seems not unlikely from the facts that the Burmese resist the action of malarial fever causes much better than the Hindoos, and they no doubt derive advantage from sleeping above the ground level. It is stated in the report, indeed, that fever cases admitted to hospital are chiefly of remittent type, and mostly from among natives of India. Fever death-rates, nevertheless, vary greatly in different regions of Burma, and are highest in three Arakan districts, where the rainfall is also highest, and where it exceeds 200 inches per annum on an average of these districts.

17. *Bowel complaints.*—Diseases registered under this head show the usual anomalies in distribution. Deaths from them were returned from all the 15 districts of the province. There are 875 circles of registration, but only 134 of these registered bowel complaint deaths, while the total number of deaths, amounting to 3,808, took place in 179 villages out of 15,551. These facts show how little confidence can be placed in the registration in some parts of the country at least.

The monthly prevalence of bowel complaints was as follows :—

Months.	Bowel Complaint Deaths.	Months.	Bowel Complaint Deaths.
January - - -	834	July - - -	556
February - - -	212	August - - -	574
March - - -	200	September - - -	412
April - - -	236	October - - -	228
May - - -	277	November - - -	181
June - - -	360	December - - -	238

On comparing these monthly data with those given in the preceding cholera table, it will be seen that the monthly increases of the two diseases resembled each other, and that both declined after the increase of rain, as shown in the abstract fever table given above.

18. It is unnecessary to make any remark on the remainder of the year's disease history, and the report contains very little information on the sanitary state of places where deaths from epidemic diseases were registered.

19. *Sanitary works (Civil).*—Under this head are given a few details of sanitary proceedings, but they convey information chiefly about works in progress, or which are to be undertaken. We shall give a brief abstract of the facts under the most populous localities.

Rangoon.—The capital of Burma had a population on the census of 1881 of 134,176. Its death-rate on a five years' average had been 34·13 per 1,000, which had fallen in 1881 to 27·28 per 1,000, and of this ratio 9·73 per 1,000 was attributed to fevers. The town is situated on low ground with little fall for drainage, on the delta of the Irrawaddy, and, like all low-lying towns, it required from the commencement of sanitary work much labour and considerable outlay to remedy the consequences of past neglects, as well as to provide for the future.

The following statement taken from the Government resolution on the present report will show the existing condition of sanitary improvement in Rangoon:—"In Rangoon the waterworks will be completed in two years, and water will then be laid on throughout the town. The scheme will not, however, be complete until filter beds are provided to purify the water. The Chief Commissioner has promised a provincial grant, equal to half the cost of these filter beds; so important does he deem the filtration of the water supplied to the city and shipping at Rangoon. A scheme of drainage has been proposed, and meanwhile a good deal of money has been spent in repairing and reconstructing the drains already in existence. Some good work has been done in raising and clearing the back drainage spaces, which have long been a disgrace to the town. It is to be hoped that the sanitary need of Rangoon will receive constant and careful attention at the hands of the elected committee shortly to be constituted there."

In regard to current work, the Sanitary Commissioner states that upwards of 5,000*l.* have been sanctioned for constructing new and repairing old drains on account of dilapidation and accumulation of "foetid sewage" in the hollows. Wherever drains of this type are used, they must be durably constructed, with proper gradients and material, and have water currents flowing through them to prevent deposits. But "a complete drainage scheme for the removal of night-soil has been approved by the municipal committee, and will be undertaken on the completion of the waterworks, if funds be available." Lake water had been brought into the town, but waited distributing arrangements. The principal roads had been raised with earth and metalled with laterite. A fish-market with marble slabs, water-taps, and a constant water-supply had been provided.

Up to the present time it appears that much good sanitary work has been done in Rangoon, and we hope it will make progress under the new municipal authorities.

20. *Akyab town* has a population of 33,980. It had a five years' average death-rate of 40·54 per 1,000, and in 1881 of 27·74 per 1,000. No work of any consequence for improving the public health was undertaken.

The sum of 1,247*l.* was spent on day conservancy. There is no removal of sewage, but "the grand work of the municipality during the season has been the almost entire completion of the main bazaar, at a cost of something like 7,200*l.*" This is no doubt a useful work, but if the town had been drained and supplied with water, the bazaar might have had drainage and water, both of which it is in want of at present.

21. *Prome*.—Population 28,813. Five years' average death-rate 42·66 per 1,000. Death-rate of 1881, 34·67 per 1,000, of which 4·30 was due to cholera.

This town was inspected by the Sanitary Commissioner, who states that the great source of sickness is the annual inundation, which leads to general disturbance of the surface, deposit of decaying substances, and injury to the water-supply. The chief sanitary requirements are stated to be good drainage, which is being proceeded with.

A hunt to prevent inundations, closure of cesspits, and thorough night conservancy.

A good supply of pure drinking water. Wells are brackish, and not to be depended upon.

Surface drains had been partly introduced, and conservancy was more or less attended to.

22. These illustrations may be sufficient to give a general idea of sanitary problems in Burmese towns, which are being dealt with by works of a simple character. The towns situated on rivers appear to be more or less subject to floods, which leave stagnant water and deposits after they subside. In other towns excessive rainfall leads to similar results, which, however, are minimized by native habits of house construction. So far as can be judged of from the reports, sanitary proceedings must mainly lie in good surface drainage, and in improving natural watercourses and outfalls to get rid of surface water as quickly as possible; equalizing surfaces with the same object; abolishing cesspits to prevent pollution of the ground; abolishing bad wells, and providing better sources of water-supply; rigid attention to cleanliness, thinning rank vegetation near dwellings to allow of free perfilation of air; these measures, together with banking out floods, appear to include the chief improvements required for the smaller class of towns and for villages. Works of a more complete kind, such as those being carried out for Rangoon, take time and outlay, and much useful experience will no doubt be obtained from Rangoon works in future.

23. Assuming that the simple surface work mentioned in the reports is of a kind to remedy the evils, there has been much of it done already, and the result to health, so far as the death-rates enable an opinion to be formed, have been that the aggregate town death-rates, which, on a five years' average, had been 30·71 per 1,000, had fallen in 1881 to 27·43 per 1,000, which is only a shade above the rate of Rangoon, where most of the sanitary work of the year has been done, at least where it has been carried out on the largest scale.

24. We learn from the Government "Resolution" that "at Akyab and Moulmein no important sanitary works have been carried out. Akyab was without an engineer for the greater part of the year, and at Moulmein want of funds has hitherto prevented the execution of any comprehensive scheme of drainage or water supply. At Prome, sanitary works were energetically carried on, a complete drainage scheme had been sanctioned, and the works are in progress." Other sanitary works are also in hand. "At Bassein 7,000 feet of brick drains were constructed during the year; the reclamation of a great part of the Athehgyee swamp was completed. Cesspits are being rapidly superseded by a more rational system (of public latrines). Water-supply schemes are being prepared for both Prome and Bassein. In Toungoo the municipality expended Rs. 23,205 on sanitary works. . . . At Henzada Rs. 97,000 were expended on sanitary works, the most important being the construction of brick drains." In the smaller towns little progress has been made; but it is a noteworthy fact that at Yandon the people themselves had combined to

introduce night conservancy. Elsewhere, however, "the cesspit system is universal." The Government further state that "a translation of Dr. Cunningham's Sanitary Primer, altered, so as to specially adapt it to Burma, has been prescribed as a school text book, and copies of the work are being distributed as widely as possible throughout the province." The object of this is to spread information, and to induce the people, especially in country villages, to improve their sanitary surroundings. "Meanwhile, district officers should lose no opportunity in encouraging and assisting the people" in this work. "In many places the adoption of a simple system of drainage, and of a few obvious and inexpensive precautions for protecting well water from contamination, would effect a great improvement in the healthiness of a neighbourhood. The people should be encouraged, as far as possible, to carry out such works themselves." All this is as it should be, and the only suggestion we would make in conclusion is that civil surgeons and vaccinating officers might usefully employ themselves in giving effect to these instructions of the Government, so far as they have time at their disposal. The Burmese people are a far more practical race than the Hindoos, and might be induced to act on advice given them, especially if backed by the new municipal authorities, whose attention might, with advantage, be called to the great importance of sanitary work, the nature and principles of which will be found fully stated in our revised "Suggestions" for the improvement of Indian stations and their vicinity, printed in 1882.

19th June 1883.

No. 11.

MEMORANDUM of the ARMY SANITARY COMMISSION on the RAJPUTANA SANITARY, VACCINATION, DISPENSARY, and JAIL REPORT for 1881.

1. This report, as its title implies, is a summary of a year's useful work rather than a Sanitary Report. It is similar in character to the Report noticed by us in our Memorandum printed in the India Office Sanitary Reports for 1880, and all that we propose to do with it is to give a brief abstract of the sanitary data which it contains, in the hope that these details may be given in greater fullness in after years.

2. The census of 1881 has not been as yet made use of in calculating the rates for the year, and as there has been an increase of population since the previous census of 1876-77 amounting to 56,744 for Ajmere and Merwara, and 1,691,238 for the Native States, the birth and death ratios for 1881 are too high.

The population for 1881 was returned as follows:—

Ajmere	-	-	-	-	453,075
Native States	-	-	-	-	11,005,512
Total	-	-	-	-	11,458,587

Facts regarding birth and death-rates at all reliable, are attainable only for Ajmere and Merwara, but there is no registration properly so called in the Native States.

3. In Ajmere and Merwara districts there were registered in 1881 the births of—

Males	-	-	-	-	6,915
Females	-	-	-	-	5,876
Total	-	-	-	-	12,791

or in the ratio of 32·27 per 1,000 of the population of 1876-77. But on the population of 1881 the birth-rate would be 28·2 per 1,000.

4. The deaths registered in the same districts in 1881 were as follow:—

Males	-	-	-	-	6,029
Females	-	-	-	-	4,720
Total	-	-	-	-	10,749

giving a death-rate of 27·12 per 1,000 on the previous census population, but a ratio of 23·7 per 1,000 on the population of 1881. In dealing with death ratios of circles and towns we must, however, accept the ratios of the census of 1876-77, and we have not the circle population for 1881.

5. There are five towns in Ajmere and Merwara which had an average death-rate in 1881 of 26·43 per 1,000, calculated on a population of 73,225, which is a shade lower than the general death-rate. The lowest town death-rate was 20·47, the highest 34·69 per 1,000. Of 18 country registration circles, the lowest death-rate of the year was 13·28 and the highest 40·27 per 1,000. It is worthy of remark that this highest rate took place in the rural circle of Nusseerabad, where British soldiers have suffered so much from enteric fever in times past.

6. The following were the chief registered death causes in 1881 :—

Diseases.	Total Deaths.
Cholera - - - - -	16
Small-pox - - - - -	1,603
Fevers - - - - -	6,510
Bowel complaints - - - - -	1,010
Injuries - - - - -	183
All other causes - - - - -	1,427
All causes - - - - -	10,749

The cholera of 1881 was a purely endemic outbreak at Ajmere. The town of Ajmere yielded 5 deaths, the suburbs 10 deaths, the Ajmere rural circle 1 death; 16 in all. There was 1 death in the suburbs of Ajmere in June, 2 in the town and 1 in the rural circle in August, 3 in the town and 7 in the suburbs in September, and 2 in the suburbs in October. The civil surgeon states that "no two cases occurred exactly in the same neighbourhood, and no common use of drinking water could be found amongst them."

No account is given of the state of the houses or their vicinity, where these cholera deaths took place. Has this defect in the information arisen from the absence of observed local causes, or from looking only in the direction of cholera poisoned water for a reason for this outbreak?

It is worth while to put the question, and to ask for a report on the state of the houses and their surroundings. The acting sanitary officer should keep in mind that, in dealing with the causes of cholera, opinions are of no use, and that facts regarding locality are what are wanted for practical purposes.

7. *Small-pox*.—The small-pox mortality presents one curious feature. All the 1,603 deaths of the year except 7, took place in the country circles, and those 7 deaths took place in three towns out of five. The provincial small-pox death-rate was 4·04 per 1,000, while the town death-rate was 0·09 per 1,000.

The history of small-pox in 1881 connects itself with the outbreak of 1880 as follows. There were 5 deaths in October, 66 in November, and 113 in December, and the monthly deaths in 1881 were :—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - - - -	147	July - - - - -	49
February - - - - -	215	August - - - - -	17
March - - - - -	321	September - - - - -	19
April - - - - -	470	October - - - - -	10
May - - - - -	238	November - - - - -	12
June - - - - -	64	December - - - - -	41

The spring months were those of highest mortality.

The total successful vaccinations in Ajmere and Merwara, which yielded these small-pox deaths, were 4,388 primary vaccinations and 45 re-vaccinations.

In the whole of Rajputana, including the Native States, the successful vaccinations amounted to 89,583, and the successful re-vaccinations were 253. The percentage of successful vaccinations was 90·42. In Ajmere and Merwara each successful case cost 36 pies, and in Rajputana 23 pies.

8. *Fevers*.—The following was the monthly incidence of fever mortality in Ajmere and Merwara districts :—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - - - - -	617	July - - - - -	363
February - - - - -	596	August - - - - -	558
March - - - - -	577	September - - - - -	824
April - - - - -	592	October - - - - -	619
May - - - - -	418	November - - - - -	525
June - - - - -	319	December - - - - -	512

and the following was the rainfall in 1881 as compared with the previous six years' average :—

Years.	January to May.	June to September.	October to December.	Total.
1881 - - - - -	Inch. 1·37	Inch. 19·43	Inch. 0·40	Inch. 21·20
Six years' average - - - - -	1·70	21·47	1·45	24·62

These amounts of rain do not account for the high fever mortality up to May. There seems to have been a period of drying up, succeeded in June by heavy rainfall, followed in September and afterwards by a second period of evaporation, during which the mortality rose.

9. There is nothing more of importance connected with fever history of the year except the varying death-rates in different localities, which lay between 5·75 per 1,000 and 30·79 per 1,000 in 1881. A similar diversity is shown by the preceding five years' averages, the lowest of which was 8·36 per 1,000, and 33·77 the highest. It is worthy of remark that, during the whole six years, the lowest rates we have given were returned from the same rural circle, Jawala, in Merwara district, and the two highest from Pisangan town, in Ajmere. The facts, and others of the same nature, point clearly to the existence of purely local fever causes.

10. *Sanitation*.—Under this head are some points worthy of notice. Ajmere town, with a population in 1876–77 of 31,583, had nearly completed its water-supply. Filtering beds and reservoirs were in the course of construction, and it was expected that water would be distributed by pipes throughout the city “in October next.” By this time, therefore, the water-supply should be in operation. But there were difficulties about the sewage question, arising from fear of failure in the amount of water in the lake, which on a former occasion had become nearly dry. The point under discussion was the possibility of removing sewage by hand labour and carts for trenching. In relation to these questions it may be well to recall the principles to be kept in view, leaving the decision to the municipality.

Water has been introduced into the town, and is certain to become an added disease cause unless provision of some kind be made for the removal of all fluid sewage and waste water produced. There are only three ways of doing this, either by providing for the careful collection and removal of as much of the water with the domestic sewage as can be kept out of the subsoil and carting it to a distance for manure, or by introducing house drainage arrangements, with closed drain pipes, to remove the sewage to a distance and apply it to agriculture, but for this there must be sufficient water. Ordinarily household water is enough for drainage purposes, but it is always safest to have separate means of flushing out lines of pipe sewers; or special arrangement should be made for collecting house sewage for removal, and then forming a system of impervious surface channels for removing the refuse house water to a distance.

The point to be aimed at is to keep the subsoil pure, and to remove as much of the water-supply of the town after it has been used as can be collected.

11. In the Native States, movement in the direction of sanitary works and measures is taking place in many parts, and in some towns drainage appears to have been provided. The chief measures relied on are, however, cleansing and prevention of nuisance, and to assist in this work a circular, originally prepared by Mr. Maconaghey, in the North-West Provinces, has been printed and circulated. The directions “have done some good directly in a few instances, and indirectly in other cases, by drawing attention pointedly to the subject of sanitation.”

It is not necessary to reproduce the circular, as we noticed it with approbation in a former memorandum. It prescribes daily cleansings, prevention of nuisance within 200 yards of villages, removal of insanitary trades, protection of drinking water, weekly reports on the state of villages; and the circular holds the headman responsible for carrying out the rules.

12. *Jails*.—The daily average strength of prisoners in Ajmere jail was 429; the average daily sick, 7; and there were 2 deaths; a mortality of under 5 per 1,000.

In the Native States there are 13 jails, with an average population of 2,783, with a death-rate of 46 per 1,000. Nothing need be said about the Ajmere experience, except that it shows a healthy jail and good management. One of the deaths was from dysentery, and the other from heart disease.

In the Native jails the death-rates varied considerably. In one jail, at Jhalrapatan, the death-rate was no less than 104 per 1,000, 32 per 1,000 of which was due to cholera.

Improvements have recently been effected in several jails, and it is to be hoped that epidemics may cease to attack prisoners as progress is made, for it should never be forgotten that preventible deaths in prison are simply deaths added to the sentence of imprisonment.

13. It will be seen that, general as are the statements in this Report, they show that good sanitary work is being done in Rajputana, and the only recommendation we have to make is that, as far as practicable, it should be continued in conformity with the practical principles laid down in our “Suggestions for the Sanitary Improvement of Indian Stations” (1882).

11th July 1883.

No. 12.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the COMMISSIONERS of the TOWN of CALCUTTA for 1881.

1. According to the census of 1881 the population of Calcutta, including all parts of it, stood as follows :—

		Area in Acres.	Population, 1881.
Town proper	- - - -	3,754	401,671
Esplanade	- - - -	1,283	3,348
Total	- - - -	5,037	405,019
Population afloat	- - - -	—	28,200
Suburbs	- - - -	14,413	251,439
Grand Total	- - - -	19,450	684,658

The first totals represent the acreage and population of Calcutta proper. The second represent the total population of what may be called the Calcutta groups, and the area on which they are located. Each of these groups, namely, the town, the suburbs, and the floating population presents its own sanitary features, but it is with the first group that the present report chiefly deals.

Calcutta proper and the esplanade yielded the following numbers, according to sex, at the census of 1876, as compared with the numbers in 1881 :—

	1876.	1881.
Males	264,863	260,780
Females	146,976	144,239
Total	411,839	405,019

These results taken by themselves would apparently lead to the conclusion that the population had declined by 6,820 since 1876, but we must bear in mind that the census numbers on each occasion merely represented the closest attainable approximations to the truth at the time, while they necessarily left out the element of movement in the population constantly going on and influenced by the conditions of labour, as well as by actual tendency to change of residence into other parts of the district. A large city, with a large surrounding population, presents elements of error in vital statistics in any case where the registration is limited within a defined area, and the population is liable to movement. But, admitting this much, the census figures of 1881 show an actual decrease in the population of city, suburbs, and floating groups of 2,026; but if the floating population be left out the decrease in 1881 will amount to 12,530.

The apparent disproportion between males and females in Calcutta is explained in the present Report by the circumstance that while on the census night 165,296 married males were enumerated, there were classed with them only 59,382 married females, showing that a large proportion of married men actually lived beyond registration limits. The numbers of unmarried men and widowers amounted together to 95,484, and of unmarried women and widows to 84,857. The facts have an important bearing on the death-rates, because they show that men whose illnesses may be due to Calcutta may die out of it.

Population, according to race, was as follows :—

Christians	- - - -	22,755
Hindoos	- - - -	278,762
Mahomedans	- - - -	124,430
Other classes	- - - -	7,272
Total	- - - -	433,219

These numbers include the floating population as well as the city and esplanade. Of this total population 369,162 were born in Bengal proper, and only 7,076 were not Asiatics. The total occupied houses on the census night were 34,534. Houses occupied only by day were 1,409; unoccupied were 2,600.

There were 77,513 families, averaging over five persons each. There were above 11 persons to each inhabited house, and the number of houses per acre was 10. The percentage of males able to read was 35·8, and of females 9·1.

These facts regarding the census population will be sufficient for the purposes of comparison, but they also show that any vital statistics founded on them should be accepted merely as approximations, and it is not easy to see how they can be rendered more reliable until the whole population which really belongs to the capital of India is included, not only in census returns, but in the registration and in deductions from it.

For the present all the data and ratios deduced from them refer to the town population only, which amounted on the census night to 401,671.

2. From among this population there were registered in 1881 the births of—

Males	-	-	-	-	-	-	3,904
Females	-	-	-	-	-	-	3,546
Total	-	-	-	-	-	-	7,450

exclusive of eight births in Fort William.

The birth-rate was 17·2 per 1,000, much too low a rate, but possibly births due to Calcutta, like deaths, may have taken place outside census limits.

3. In 1881 the following deaths were registered—

Males	-	-	-	-	-	-	7,709
Females	-	-	-	-	-	-	5,321
Total	-	-	-	-	-	-	13,030

equal to a death-rate of 30 per 1,000 against a previous 10 years' average rate of 28·7 per 1,000. Calcutta has now for a number of years been supplied with drainage works and water, but still in a very incomplete condition as to details, and we may now compare the rates in years past to see exactly where we have arrived at in the matter of disease prevention. The following have been the death-rates since 1871 :—

Years.				Death Ratio per 1,000.	Years.				Death Ratio per 1,000.
1871	-	-	-	23·7	1877	-	-	-	31·6
1872	-	-	-	23·8	1878	-	-	-	37·8
1873	-	-	-	23·8	1879	-	-	-	30·1
1874	-	-	-	26·6	1880	-	-	-	26·9
1875	-	-	-	32·5	1881	-	-	-	30·0
1876	-	-	-	29·9					

Some allowance must be made in dealing with these figures for two circumstances, namely, that the three earlier years are manifestly incorrect in their death-rates. Either there were too few deaths registered, or deaths due to Calcutta took place out of the registration area, and the year 1878 was a year of scarcity of food, which, no doubt, raised the death-rate of that year, but an answer is required to this question, Why have the rates of the three last years in the table not continued to fall? As we shall presently see, the drainage works have been making progress, and most of the scheme has been completed; but the water-supply has not been adequate to the wants of the people. It is, however, being improved, yet it appears as if some other cause or causes had become of increased importance, and we must see whether any clue to these can be found in the year's disease history, which we shall now discuss.

The following were the deaths registered in 1881 under the usual headings :—

Diseases.	Total Deaths.
Cholera	1,693
Small-pox	133
Fever	3,765
Bowel complaints (diarrhoea and dysentery)	1,491
Other causes	5,948
All causes	13,030

We shall deal with each of these registration headings separately, beginning with—

Cholera.—The cholera history of 1881 presents some points of practical importance which appear to require notice, but before entering on these we may introduce the following abstract, showing the relation of this disease to rainfall, humidity, and temperature.

Months.	Mean Temperature.	Temperature Range.	Humidity.	Rainfall, Inches.	Cholera Deaths.
January	63·4	22·4	66	—	63
February	71·9	23·0	67	—	72
March	76·4	19·7	72	3·45	227
April	85·3	19·8	73	1·97	370
May	84·1	15·2	76	7·40	138
June	83·3	9·8	86	15·12	36
July	83·0	8·5	87	13·42	49
August	83·5	8·7	89	19·61	52
September	82·9	10·0	87	6·75	80
October	79·7	13·4	82	1·50	100
November	71·9	19·2	70	—	232
December	60·9	22·9	71	0·36	267

This table shows that cholera mortality was lessened by increase of rain, and rose with diminution of rain; that the highest death-rates took place in months with highest temperature ranges; that

high mean temperatures and high rates of humidity were not attended by higher cholera death-rates. Moreover, it is shown by past data, that the elements of 1881 did not differ from those of preceding years to any material extent.

5. The Officer of Health's report enables us to show the annual deaths from each of these death causes since 1871, and as the population has not materially changed of late years, the figures which give the total deaths may be safely assumed as showing the extent of annual liability to death from each cause.

The following have been the annual deaths from cholera within the same periods, for which we have given the total deaths :—

Years.				Cholera Deaths.	Years.				Cholera Deaths.
1871	-	-	-	796	1877	-	-	-	1,418
1872	-	-	-	1,102	1878	-	-	-	1,338
1873	-	-	-	1,195	1879	-	-	-	1,186
1874	-	-	-	1,245	1880	-	-	-	805
1875	-	-	-	1,674	1881	-	-	-	1,693
1876	-	-	-	1,851					

During all these years main drainage and improved water-supply have been making progress in Calcutta, and it appears to be necessary to ask the question, not only in the interest of sanitary principles, but of municipal application of these principles, how it happens that such a series of figures as this abstract shows could possibly have presented itself? The data include the years during which works of drainage, water-supply, and conservancy, such as it has been, may have influenced the sanitary condition of the population, and the present inquiry relates only to this period, which, unsatisfactory as its results as regards cholera have been, still contrasts favourably with the normal condition of matters before real sanitary work was in progress. This is shown as follows :—

Years preceding effects of Sanitary Work.				Deaths from Cholera.			
1865	-	-	-	-	-	-	5,078
1866	-	-	-	-	-	-	6,826
1867	-	-	-	-	-	-	2,270
1868	-	-	-	-	-	-	4,186
1869	-	-	-	-	-	-	3,582
1870	-	-	-	-	-	-	1,558

Some work was done during the years in this series also, but the average results must be looked for in years subsequent to 1870, given in the preceding abstract, which shows a tendency to increase of cholera mortality, so that while the mean cholera death-rate during 10 years of sanitary work has been represented by 1,252 deaths, the number in 1881 had risen to 1,693. There must be a reason for this result, and it may be safely said that some one is responsible for it.

6. The actual cholera death-rate for the city was 3·9 per 1,000 in 1881, but it differed greatly in different sections of Calcutta. In Park Street section it was 0·8 per 1,000, the lowest ratio. The highest, 5·5 and 6·6 per 1,000, were registered in Burtollah and Coomertooly sections. The death-rate in Hastings section was 4·8 per 1,000.

As cholera is an epidemic disease, the aggravating causes of which are mainly local, these facts apparently point to the presence of unremoved local causes. This view is, moreover, sustained by facts of another kind. For example, the suburban population living outside the limits of municipal sanitary works yielded a cholera death-rate in 1881, not of 3·9 per 1,000, like the rate of municipal Calcutta, but of 7·4 per 1,000. This is not an accidental rate, but is approximately of annual occurrence. Again, the Officer of Health calls attention to the acknowledged greater liability to cholera of non-Asiatics living in India, and that nevertheless these have a lower cholera death-rate in Calcutta than natives, and he attributes this comparative exemption to the better sanitary condition under which Europeans live.

We have next the remarkable facts respecting the law of cholera distribution in 1881, "that cholera was distributed sporadically throughout those parts of the town habitually prone to it, and that no localization or spread of an epidemic kind became manifest." And this brings us to the discussion of the local causes of the sporadic cholera of 1881. "The same tendency," we are told, "to grouping around foul tanks and filthy wells was observed as in former years." This was the rule, but there was no apparent aggravation of these customary causes, except in one instance, where carelessness led to an outbreak. The facts are stated as follow. They relate to a collection of huts called Seth Bazan, which presented the usual sanitary defects of foul tanks and general uncleanness in houses, drains, &c. Cholera had broken out, and 27 deaths had occurred in the vicinity.

"On the 26th March some sweepings were, through a mistake of the Conservancy Department, thrown into the more southerly of the two tanks, which had not been previously de-watered. The villagers went on using the water for bathing, washing dishes, &c." Up to 2nd April three cases and two deaths took place near the tank. "On the 5th April a quantity of putrid dall, which had been condemned by me, was, through a mistake of the Conservancy Department, thrown into the tank. The material exhaled a foul stench, but the people still went on using the water." The result was the occurrence of eight cases of cholera, out of which seven proved fatal, and two fatal

cases took place near a foul drain. The Officer of Health adds to this lamentable detail that "the tank has now been filled up, the drains piped, and the village generally improved, and since the events described no report of unusual sickness or mortality has reached me."

The practical result of the whole cholera history in Calcutta is thus stated by the Officer of Health:—"I am convinced that in the general sanitary improvement of the town, the increased supply of pure water, the obliteration of foul tanks, hollows, and surface drains, the completion of the underground sewer system, better means and more efficient carrying out of conservancy, general and special, and improvement of bustees, resides the hope of reducing the incidence of cholera in Calcutta." He adds, that "the disease prevailed mainly in the dirtiest portions of the town, and amongst the poorer classes of dirtiest habits," and that "about 90 per cent. of cholera deaths occur among the lowest classes of the community, the inhabitants of the bustees."

7. With these official facts before us, the question naturally suggests itself whether they do not involve a grave charge of neglect of duty on the part of the Municipal Commissioners or their executive officers. We have less reserve in asking the question, because our Memoranda have shown year after year that we have had every disposition to acknowledge the large amount of really good work which has been done, and yet we have this startling fact to deal with, that cholera, which is a disease mainly related as to its predisposing causes to filth in air, earth, and water, shows a tendency to increase in amount, notwithstanding the extension of drainage and water-supply.

This question will be reverted to after we have dealt with the remainder of the disease history of 1881.

8. *Small-pox*.—The monthly mortality from this disease was as follows:—

Months.	Small-pox Deaths.	Months.	Small-pox Deaths.
January - - -	5	July - - -	1
February - - -	28	August - - -	—
March - - -	42	September - - -	—
April - - -	40	October - - -	1
May - - -	11	November - - -	—
June - - -	10	December - - -	—

The total small-pox deaths in the year amounted to 133. The births of the year were 7,450, and the vaccinations and revaccinations were 6,538, of which 5,511 were successful. The successful primary vaccinations amounted to 5,416, or five sevenths of the births. Of the vaccinations 2,181 were of infants under one year of age, and 2,380 vaccinated were above one and under six years of age.

9. *Fevers*.—The annual deaths from diseases classed as fevers for 11 years, have been as follows:—

Years.	Annual Fever Deaths.	Years.	Annual Fever Deaths.
1871 - - -	4,242	1877 - - -	5,151
1872 - - -	4,895	1878 - - -	6,086
1873 - - -	4,632	1879 - - -	4,796
1874 - - -	4,461	1880 - - -	3,797
1875 - - -	5,328	1881 - - -	3,765
1876 - - -	4,361		

As the population of Calcutta has not differed materially in late years, these figures may be taken as representing the annual fever liability since 1871. The year 1878, with its highest mortality in the series, shows the effect of scarcity of food in that year. The fever death-rate has been subject to fluctuations, but during the last two years it has notably diminished, while, as we have already seen, the cholera death-rate of 1881 had very decidedly risen. We have already shown that there has been no important change in the meteorology of 1881 from the average, and it appears to follow that some local conditions favourable to the existence of fever have become lessened, while those favourable to cholera have been increased.

10. The following abstract gives the monthly incidence of fever mortality in Calcutta during 1881:—

Months.	Fever Deaths.	Months.	Fever Deaths.
January - - -	397	July - - -	260
February - - -	324	August - - -	274
March - - -	314	September - - -	275
April - - -	317	October - - -	343
May - - -	244	November - - -	400
June - - -	188	December - - -	429

By comparing these numbers with the meteorological data already given, it will be seen that the highest fever mortality took place in the months of lowest temperatures, with highest temperature

ranges, and after cessation of rain when evaporation was added to these temperature elements; but, as already stated, these variations are only in the monthly data in a given year, while in the years of a series the data have not varied so as to increase or diminish with the fever deaths during the series.

11. The fever death-rate of 1881 was by no means equally distributed over the town. The lowest rates were 3·5 per 1,000 in Waterloo section, and 4·6 per 1,000 in Park Street section. The following sections yielded rates above 10 per 1,000 :—

					Per 1,000.
Toltoolah -	-	-	-	-	10·4
Bamun bustee -	-	-	-	-	11·2
Coolootolah -	-	-	-	-	11·8
Burra bazar -	-	-	-	-	11·5
Collinga -	-	-	-	-	11·7
Hastings -	-	-	-	-	20·1

There are questions raised by these figures which could only be dealt with on the spot; but the death-rate of Hastings is so very high that there must apparently be some tangible reason for it.

Uniform experience has proved that in India, as elsewhere, high death-rates from malarial fever are connected with stagnant subsoil water, but generally in Indian towns there are foul tanks yielding not only malaria, but bad drinking water, and disease causes of this class must not be overlooked in discussing the relation between fever and drainage defects.

12. Besides, the exact nature of these fatal fevers is imperfectly known. Not many years ago they would have been all classed as intermittent or remittent, and afterwards a large proportion were entered under the head of enteric fever, which at the time was supposed to be connected with the new drainage system. There was at the same time a general disposition in certain quarters to connect this fever with house drainage elsewhere than in India, but it happens as a fact, that the enteric fever death-rate in India is furnished by places where there are no drains. There is no doubt, however, that fatal enteric fever takes place in Calcutta, but by no means to the extent that has been supposed. Of deaths so registered, 515 were found by the Sanitary Commissioner to have occurred in children under five years of age, and only 54 for all the remaining ages. During the last eight years, there were 14 post-mortem examinations made at the Medical College hospital of Europeans and Eurasians who had died of fever, of which only two presented the lesions of typhoid fever.

During the same years, 108 examinations of fatal fever cases among natives were made, of which only five showed typhoid characters. With these facts before us, we must apparently conclude that the mortality from fever in Calcutta is mainly due to malarial fevers, aggravated in all probability by local and household sanitary defects.

13. *Bowel Complaints.*—These are classed in the Calcutta Report under the designations of diarrhoea and dysentery, and have yielded the following deaths during the same 11 years period already used for cholera and fever :—

Years.				Bowel Complaint Deaths.	Years.				Bowel Complaint Deaths.
1871	-	-	-	1,488	1877	-	-	-	1,688
1872	-	-	-	1,865	1878	-	-	-	2,010
1873	-	-	-	1,851	1879	-	-	-	1,516
1874	-	-	-	1,858	1880	-	-	-	1,267
1875	-	-	-	1,579	1881	-	-	-	1,491
1876	-	-	-	1,864					

The year of highest bowel complaint death-rate, 1878, was the scarcity year, and 1881 has a corresponding increased rate from these diseases to that shown in regard to cholera in the preceding table, and to complete the parallel we shall abstract the monthly deaths under this head as follows :—

Months.				Bowel Complaint Deaths.	Months.				Bowel Complaint Deaths.
January	-	-	-	190	July	-	-	-	95
February	-	-	-	124	August	-	-	-	96
March	-	-	-	123	September	-	-	-	92
April	-	-	-	107	October	-	-	-	108
May	-	-	-	102	November	-	-	-	153
June	-	-	-	67	December	-	-	-	234

By comparing this table with the preceding one showing the relation of cholera mortality to meteorology, it will be seen that the elements which increase bowel complaint mortality are the same as those which influence the cholera death-rate, namely, falling temperature and increased temperature range. But neither of these climatic conditions could of themselves give rise to the increasing

epidemic death-rates, which we are sorry to see have passed over to the year 1882 following the present report, for the Officer of Health's more recent returns show a rise in the total death-rate of Calcutta to 30·5 per 1,000, while the total cholera deaths, which in 1881 amounted to 1,693 had risen in 1882 to 2,240, and the fever deaths, which numbered 3,765 in 1881, were 3,610 in 1882, no great reduction, but showing apparently that there has been some constant cause of reduction in fever mortality in operation, for the fever deaths of 1882 were lower in number than those of any previous year, while the cholera death-rate was the highest which has presented itself since 1870. We shall next abstract a brief statement to show what is the present condition of sanitary work in the city, and whether this affords any satisfactory explanation of the facts.

14. *Drainage.*—The original drainage scheme included 10·78 miles of first-class sewers, and 23 miles of second-class sewers. Both were completed by the end of 1880. But besides these there were 154 miles of third-class pipe sewers, of which, all but 21·12 miles were completed by the end of 1881, leaving this length to be laid in subsequent years. The great work of sewerage and draining Calcutta and freeing its subsoil from water was thus nearly finished.

The number of premises connected with these sewers is 16,400, or nearly one-half the premises of Calcutta. The amount of sewage per diem pumped out of the sewerage system and discharged at the outfall in 1881 averaged 13,471,570 gallons, against the previous year's daily average of 13,529,345 gallons. The difference is not great, but it raises the following point for consideration. The use of the entire drainage system, including its pumping arrangements, is to keep the sewers empty, and to prevent stagnation, back watering, and deposit. Now, if from any mistaken economy, the pumping is reduced, one result and one result only can follow, namely, the accumulation of sewage and deposit under the houses, and of water in the subsoil, and increase of fever. Efficient pumping is as much a part of the sewage system as are the sewers. It appears from the report that want of flushing has already been experienced, and it is just possible that part of this defect may have been due to the cause stated.

The filtered and unfiltered water-supply of 1881 was 8,442,770 gallons per diem, only part of which would enter the sewers. The sewage pumped was hence a third more than the water-supply. The remainder would be due to rainfall entering the sewerage system, or part of it. The total fall according to the Officer of Health was 69·58 inches, which was 3·20 inches above the average.

House connections with the sewers have to be refused on account of want of sufficient water, "and hence," says the engineer "it must be again recorded that the principal object for which the sewerage system now rapidly approaching completion was designed remains unfulfilled."

In this incomplete state of water-supply arrangements, the night-soil has to be removed by 1,100 mehters from 37,940 privies, and then follows this important statement:—"The number of privies in 1878 was 31,460, served by 1,368 mehters, consequently the work has increased 20 per cent., while the number of mehters has decreased by upwards of 19 per cent." The night-soil from latrines and privies is carried to 27 dépôts, where it is run into the sewers with water, and thence to the pumping station at the outfall. Complaints of inefficiency of service have been very few, but it is easy to see how any remissness in this important department of public service may be followed by sickness.

Thus far we have two facts regarding fever mortality, namely, extension of the drainage works and removal of sewage and lowering of subsoil water level, with decline in general fever mortality over the under-drained area.

15. The suburban area is not under-drained, and while the fever death-rate of the whole drained town area averaged 8·6 per 1,000, the fever-rate for the undrained suburban area was 19·6 per 1,000. We have already seen that the fever death-rate varies in different divisions of Calcutta, but in regard to only one of these divisions, Hastings, have we the means of contrasting the fever death-rate with the drainage. Hastings is not under-drained, and its fever death-rate in 1881 was 20·1 per 1,000, which it will be seen is a little higher than the rate of the undrained suburban area. The drainage of Hastings has been deferred for want of water. These facts have a very important bearing on the relation of subsoil cleansing and drainage to fever mortality, and they belong to a class of experience which may eventually show the necessity of under-draining all Indian towns. They are in entire consistence with experience obtained in the open country as to the relation between subsoil water level and fever prevalence, and their practical result would, no doubt, be to prove that surface drained towns could not attain to any high condition of health. Even at present, as we have shown shown on other papers, there are surface drained towns which show very high fever and general death-rates.

16. This appears to constitute the reply to the first part of our question why there has been a falling fever-rate, with a rising cholera rate, but before following up the other part of the inquiry, it is necessary to notice the question of enteric fever in connection with Calcutta sewerage.

A number of years ago an outcry was raised in England against house cleansing by sewers because, in some cases, there had been enteric fever in drained houses. This opinion was carried to Calcutta just at the commencement of the drainage works there; and, in consequence apparently of English opinion on the subject, the proposed drainage scheme for Calcutta was unsparingly condemned. This opinion, however, gave way before experience, and we now know, as already stated, that the great majority of typhoid fever cases among Europeans in India take place where there are no sewers or drains, and that the etiology of enteric fever is by no means so simple a problem as the sewer theory takes for granted.

The record of enteric fever in Calcutta appears to have alternated in amount with the record of remittent fever. True enteric fever is a rare disease apparently in Calcutta, but cases have happened where blame has been laid on the sewers. Sewers themselves, unless in a ruinous condition, or unless they are so constructed as to become sewers of deposit, cannot occasion enteric fever, but there are matters of detail which, if neglected, might, under certain conditions, occasion enteric fever attacks. We have already alluded to defective pumping at the outfall as one of these. Again, all sewer systems require flushing, a means of cleansing as yet imperfectly adopted in Calcutta. All sewers, again, require ventilation, and most important perhaps of all, there ought to be no direct connection between any house drain and any sewer. The required precautions are not difficult of execution, and are described in our revised "Suggestions" of 1882. They are simply part of the drainage arrangements of the city, and if they are left out of calculation no one has any right to complain if enteric fever cases occur occasionally.

17. *Conservancy*.—From what has been said regarding experience already obtained as to local fever causes, it may be safely assumed that the fundamental cause requiring to be dealt with is foul subsoil and stagnant subsoil water, and that the real remedy for high fever death-rates lies in extending the works of drainage until both city and suburbs are subsoil drained throughout, and foul tanks abolished. But while insisting on this fact, we cannot forget that fever types and fever mortality are both aggravated by local filth causes, and that these causes also increase the fatality of cholera. For practical purposes therefore we must inquire to what degree of efficiency the present conservancy system has attained, what are its defects, and how they are to be remedied, and in this way we may arrive at some explanation of the increase of cholera mortality. The following is the account given by the Engineer of the working of the present system of conservancy. "Refuse is, as a universal rule, thrown out from the houses and deposited in heaps by the occupiers. . . . The street litter having been swept up into heaps and the house refuse thrown out, the carts do their work of collecting the sweepings and refuse, and convey them either to tanks that may be in the course of filling, or to the platforms (of which there are six) of the municipal railway, where they are tipped into waggons and hauled away to the Salt-Water Lakes for final disposal. . . . The work in the town streets is usually completed by 11 a.m. or noon."

This is all plain enough, but in practice the following difficulties were met with:—"At the commencement of the year great difficulty was experienced owing to the inability of the gowkhanahs to supply carts and cattle up to the budget provision, and in consequence box carts had to be hired to do the work. The full budget number was available during the second quarter, but it has to be admitted that they were inadequate. The want of carts and cattle becomes an aggravated sore, and causes distress of a most threatening nature on the occurrence of rain, and more or less throughout the rainy season, when the sweepings and refuse become heavy with wet, and the general dirt to be removed becomes greater in quantity, men and cattle become overworked, the operation of cleansing becomes delayed to a late hour of the day, and many back streets and lanes are left to take their chance with festering heaps of muck and garbage. Of course, as much as possible is done by hiring carts, but there is a limit to this, as the demand for carts throughout the town is very great and is increasing."

"Then the want of wagons at the railway platform has oftentimes aggravated the evil to an intense degree; the loaded carts have had to be taken into the gowkhanahs and emptied at the platforms in the early morning into waggons which have been brought to the platforms overnight, thus entrenching on the time that they should have devoted to collecting the dirt of the town. On several occasions there were great apprehensions of utter collapse."

These facts stated by the engineer of the municipality, apart from the condition of tanks and bustees, would be sufficient to explain the late increase of cholera mortality, and we are glad to see that their importance is insisted on by the Chairman of the Commissioners in his report. "A sufficient establishment of conservancy carts," he says, "is also a *sine quâ non* to remove the annually increasing heaps of refuse which are being brought within their reach. Above all, effectual and intelligent supervision over the nuisance and night-soil departments, and the systematic enforcement of the conservancy sections of the law, is indispensably requisite. These questions are under the consideration of the special conservancy committee now sitting." Of course, we have no information as to the intended improvements in the cleansing service, but it is clear that, up to the date of the report, the public health in the capital of India was subject to a danger, which was long thought to be a matter of the past, namely, cholera epidemics, to a great extent due to insufficiency in cleansing, and want of a rigid organisation in the cleansing department. The rainy season and its requirements, and not the dry season, ought to be adopted in future as the measure of plant and of work required for city conservancy. The Officer of Health has told us that cholera increase has been of a sporadic kind, but, under the conditions described by the engineer, the disease may at any time become epidemic, and make its appearance in quarters where it is least expected.

18. This want of thorough general cleanliness and keeping clean is, however, only one of the causes of these sporadic cholera outbreaks, but it is, perhaps, the cause of most importance, because it admits of immediate removal. Others, requiring more time for eradicating them, are the foul tanks and bustees, to which we have often referred in previous memoranda.

Bustee improvement has been commenced by inspection and registration of them. The number of these disease centres on the register at the date of this report was 486, and of these 48 had been surveyed and plans of improvement made, but, unfortunately, the existing legal powers do not make

the committee sanguine of being able to effect "any very substantial improvement" in their sanitary condition. "At every step the bustee committee finds its projected improvements hampered by the legitimate objections of proprietors, so that such works as can be eventually insisted upon fall very far short of the ideal project as first planned;" and there follows this account of the present state of matters:—"The refuse which now remains in bustees unremoved, and which the opening up of roads will enable the Commissioners to remove, is not by any means the greatest sanitary defect. The foul and filthy drains which intersect the bustees, full of festering sewage and manure, is a far greater evil; and, while little can be done to remove this under the bustee sections, there are other sections under which the corporation have power to remove these evils, though not without some expense. The filling up of tanks, a very important measure, can be done without resorting to bustee procedure."

It will be seen that the practical result of this state of the case is simply as follows, that a considerable area of Calcutta, upwards of 3,054 beegahs, inhabited by a large crowded population, does not admit of being properly cleansed, apart altogether from tank filling and draining.

The question may be asked, whether this dangerous evil is to be allowed to continue, or whether the owners ought not to be compelled to keep their properties clean. Surely they can be required to collect and deposit in some convenient place all the bustee filth, to be then removed by the municipal officials, until proper road improvements may enable the municipal authorities to undertake the work, and to cleanse and keep clean all drains.

Opening up of bustees appears to be a slow process, for in the first case taken in hand the final orders were not issued until 13 months after the first inspection, and it was calculated that six or seven months would elapse before the works were completed. Yet all this time the more immediate disease cause to be dealt with, namely, the filth and cholera consequent on its presence, is to be left for indefinite periods.

19. We have so frequently described the sanitary, or rather the insanitary, results of Calcutta tanks, that it is unnecessary to revert to this potent disease element. In 1879, when a survey of the tanks was first made, there were 534 of them. Since that time 34 tanks have been taken in hand, leaving 500 untouched.

The Commissioners appear to consider that if in the next five or six years 100 of these can be filled up it will be good work. No doubt time must elapse before such an immense surface as these tanks present can be covered, but on the score of public health and economy it may be safely said that no outlay that can be incurred to abolish them forthwith ought to be complained of. We formerly gave a caution against using any putrescible refuse for filling, and this caution, as we have already seen, has been further enforced by cholera experience in 1881.

20. From what has been said it will be seen that increase of cholera in Calcutta is a perfectly legitimate consequence of filth unremoved and accumulating among the dwellings of the people, and we have also seen where the blame of this lies. But these remarks are not intended to detract from the credit justly due to the local authorities of the city for the works of drainage and water-supply they have carried out, which, however, in no sense lessen the obligation resting on them to persistently cleanse and keep clean every corner of the city.

21. *Water-supply.*—The following is a brief digest of information contained in the report on this important subject.

There are six settling tanks at Pultah, each 500 feet long by 250 feet broad and 7 feet deep, into which water from the river is raised by steam power. Thence it is filtered by 12 filters, each 200 feet long by 100 feet broad. The filtered water flows by gravitation through a 42-inch main to Tallah, where there is engine power by means of which it is forced into the town mains, to Wellington Square pumping station, where it is raised by steam power for distribution. The total number of premises connected with the water mains in 1881 was 13,386, out of a census total of 34,534 houses.

The average daily consumption of water in 1881 was 7,208,453 gallons.

The house connexions are made by 26 licensed firms of plumbers, and every connexion is personally supervised by the municipal inspector. In the course of the year water inspections were made, 26,190 in number, to discover the condition of fittings, and 3,189 leakages were found and repaired. Additional hydrants were put up. But as we showed last year, hydrant water should be supplied to the bustees, where water at present is little better than sewage. An analysis of hydrant water shows that, taken over all, the quality was of the usual annual average, but in certain details the results showed defective filtration on certain days, which the engineer accounts for by an excessive amount of suspended matter in the river water, and difficulties in the way of filtration. There appear to have been local defects also in the depositing tanks and filters. These, no doubt, will be remedied, but we have referred to them in order to suggest that it is just as necessary for protection of the public health to see to the constant efficiency of all sanitary works as to see to their original execution.

This matter is forcibly dwelt upon by the chairman of the Commissioners in his own report, who states that the filtered water is more and more in demand, so that the present amount of water is "very insufficient, and is daily becoming more so."

This result was foreseen by the Army Sanitary Commission, who gave a caution on the subject before the works were commenced, which had it been followed would have saved much outlay in extending the supply.

22. *Barrackpore water-supply.*—This supply comes originally from the Calcutta source, and is provided as follows :—

- “(1.) One filter, 72 feet by 50, capable of delivering 180,000 gallons in 24 hours.
- “(2.) Two compound direct-acting pumping engines capable of delivering 10,000 gallons per hour to a height of 70 feet.
- “(3.) One elevated reservoir in the cantonments of Barrackpore 35 feet 6 inches high, capable of holding 120,000 gallons.
- “(4.) Seven miles of mains and service pipes from 9 inches to two inches diameter, and 19 stand-posts.
- “(5.) And lastly, service pipes and fittings for the supply of all the Native Infantry lines and European barracks, with all their several bath-rooms and cook-houses.”

The actual cost of the works was 10,044*l*.

The daily average water-supply has been 35,961 gallons since the works were completed.

It is to be hoped that since the Barrackpore problem has been at last solved at so moderate an outlay, this example will be followed at many similarly situated stations.

23. *Unfiltered water-supply.*—This water is pumped direct from the river, and is laid on by separate service to hydrants for street purposes, and for latrines, night-soil depôts, &c. The amount of water used for these purposes in 1881 was 1,257,300 gallons per diem, and was of course so much saved of the filtered supply.

24. There are a few other points in the Report under review which might have been noticed, but they occupy quite a subsidiary place when compared with that which is the real problem to be dealt with by the Calcutta municipality, namely, the great increase of liability to epidemic outbreaks notwithstanding the execution of works of drainage and water-supply. Sanitary improvement would be an easy enough matter if it depended solely on the carrying out of engineering works, and then leaving them to themselves. But engineering works are only a means to an end, and whether they finally succeed, or finally fail, depends entirely on the degree of care bestowed on their working. Again, it is by no means sufficient to organize in any way nearest at hand, the conservancy department of a great city, which of all parts of sanitary work is the one most immediately necessary for protecting the public health. With a system so disjointed as the conservancy department described in this Report, increase of cholera follows as a matter of course.

The experience is no doubt valuable, but the people who have suffered are not those who were charged with its execution, towards which many of them no doubt paid rates.

The practical teaching is that the whole sanitary work must be much better done, and that of all sources of economy which a municipality can deal with, the very last, and in the end the most costly to the entire community, is not providing for the efficient discharge of sanitary duties. We do not know to what extent economizing may have been adopted in the present case. We can only judge by the results given in the Municipal Report of the year, and of the unsatisfactory nature of these there can scarcely be two opinions.

12th June 1883.

No. 13.

MEMORANDUM of the ARMY SANITARY COMMISSION on the ADMINISTRATION REPORT of the MADRAS MUNICIPALITY for 1881.

1. The present year's Report is mostly devoted to municipal administration details and statistics not calling for remark, and there is very little in it bearing on questions of public health or on the prevention of disease. Our estimate of the general sanitary state of the city must, therefore, be based on the experience of past years, and we shall take from the Report for 1881 such facts as may continue the history to the end of that year.

2. The house population of Madras at the time of the census of 1881, when compared with the same class of population at the previous census, yields the following comparisons :—

	Years.	Males.	Females.	Total.
1871	- - - - -	191,924	201,996	393,920
1881	- - - - -	193,635	204,277	397,912
	Increase in 1881	1,711	2,281	3,992

The house population of 1881 was lodged in 47,405 occupied houses, or at the rate of 8·4 inhabitants per occupied house, but there were 15,988 unoccupied houses, or above 25 per cent. of the total house accommodation.

Besides the house population of 1881, there were the following groups which went to make up the total inhabitants :—

	Males.	Females.	Total.
Fort St. George - - -	830	331	1,161
Houseless poor and travellers - - -	4,204	1,399	5,503
Marine population - - -	1,028	40	1,068
Canal and travelling - - -	311	4	315
Railway and travelling - - -	116	42	158
Total - - -	6,489	1,716	8,205

The actual census population was therefore :—

Males - - -	200,124
Females - - -	205,993
Total - - -	406,117

Omitting the marine and travelling population, which were not included in the census of 1871, the remainder of all classes was as follows :—

	Population.
1871 - - -	399,140
1881 - - -	404,636
Increase in 10 years - - -	5,496

But of this increase 1,871 was due to houseless and travelling poor, so that to all intents the population of Madras is stationary, but, if judged by the number of uninhabited houses the population has actually been decreasing or becoming poorer, with less means of paying for house room.

3. The registered births in 1881 were, of—

Males - - -	7,841
Females - - -	7,635
Total - - -	15,476

or 38·9 per 1,000 of population. Besides these living births, there were 549 still-born in the course of the year.

4. Registered deaths in 1881 were, of—

Males - - -	7,784
Females - - -	7,703
Total - - -	15,487

The calculated death-rate was the same as the birth-rate, namely, 38·9 per 1,000, the mark of a decaying population.

5. The following abstract gives the death-rates calculated on the resident population since 1870 :—

Years.	Death Ratios per 1,000.	Years.	Death Ratios per 1,000.
1870 - - -	29·9	1876 - - -	39·6
1871 - - -	32·7	1877 - - -	99·9
1872 - - -	35·2	1878 - - -	47·5
1873 - - -	36·7	1879 - - -	34·7
1874 - - -	36·8	1880 - - -	37·4
1875 - - -	35·5	1881 - - -	38·9

During the earlier years of this series, the registration appears to have been less complete than in recent years. In 1876 the first foreshadowing of the famine mortality began to appear. In 1877 came the famine, and the almost 10 per cent. death-rate of the year includes the deaths from starvation and famine diseases amongst a great influx of poor starving people from the country, whose deaths appear to have been calculated on the resident population. In 1878 the calamity had not entirely passed away, but it is probable that the two last years in the series show approximately the normal death-rate of Madras in non-epidemic years.

6. The city of Madras includes 36 population groups or villages, in which the death-rates ranged considerably above as well as below the total average.

The lowest death-rate of the year was 2·5 per 1,000 in Fort St. George. In four villages the rates were under 20 per 1,000. In three they were between 20 and 25 per 1,000. In seven the rates lay between 30 and 40 per 1,000. But all the others had rates exceeding 4 per cent. The highest rates were 40·7, 46·4, 58·4, 64·3, and 65·1 per 1,000. The facts show that disease and death causes are grouped in special localities, in which the work of the sanitary improver is most required.

7. Unfortunately, the present report contains no information of the local causes on which these great death-rates depend.

8 The next abstract gives the total deaths from each principal cause in 1881 :—

Diseases.					Total Deaths.	Ratio per 1,000 of Population.
Small-pox	-	-	-	-	1,654	4·1
Measles	-	-	-	-	299	0·7
Fevers	-	-	-	-	3,698	9·3
Dysentery	-	-	-	-	1,225	3·0
Diarrhoea	-	-	-	-	700	1·7
Cholera	-	-	-	-	126	0·3
Injuries	-	-	-	-	64	0·1
Other diseases	-	-	-	-	7,721	19·4
Total	-	-	-	-	15,487	38·9

It will be seen that the least important disease of the year was cholera. But in Madras cholera is liable to great variations in intensity, as will be seen from the following annual deaths from this epidemic disease :—

Years.				Cholera Deaths.	Years.				Cholera Deaths.
1870	-	-	-	861	1876	-	-	-	2,105
1871	-	-	-	493	1877	-	-	-	3,025
1872	-	-	-	5	1878	-	-	-	85
1873	-	-	-	6	1879	-	-	-	35
1874	-	-	-	—	1880	-	-	-	2
1875	-	-	-	935	1881	-	-	-	126

Madras appears to be liable to sudden and severe outbursts of cholera. The high death-rate in 1877, the famine year, was apparently the culminating point of one such epidemic.

9. In 1881 the deaths from cholera all took place in 12 population groups, and in several of these there were only one, two, or three cases. The disease was strictly endemic. The largest number of deaths, 23, took place in a fishing village, Cashmode, containing a population of 12,383, in November and December. No sanitary account is given of the houses or localities where cholera took place. Only stress is laid on the fact that there were dhobies where there was cholera; but we are not informed whether there were dhobies where there was none. It is simply an erroneous way of recording coincidences.

10. The most satisfactory part of the year's cholera history was, that additional sanitary precautions, especially in the way of conservancy and warning against the use of bad water, were taken, and that the people were warned to be careful when diarrhoea cases occurred.

As a general rule it may now be considered as established by experience that the best temporary safeguards against cholera, when epidemics are in the air, is perfect cleanliness of houses, persons, and their surroundings, and the use of pure drinking and culinary water.

11. *Fevers*.—It will be seen from the following abstract that if the registration were entirely reliable, fever mortality is on the increase since the famine year 1877 :—

Years.				Fever Deaths.	Years.				Fever Deaths.
1870	-	-	-	2,296	1876	-	-	-	2,351
1871	-	-	-	2,474	1877	-	-	-	6,407
1872	-	-	-	2,848	1878	-	-	-	4,982
1873	-	-	-	2,569	1879	-	-	-	3,465
1874	-	-	-	2,679	1880	-	-	-	3,549
1875	-	-	-	2,445	1881	-	-	-	3,698

Fever is a famine disease, as is distinctly shown by the high death-rates in 1877–78, but experience in subsequent years must be taken as showing increase of local fever causes, or increased susceptibility in the population. All the population groups, except four, yielded fever deaths in 1881, but the disease was far more prevalent in some villages than in others.

The great remedy for fevers is drairage, cleanliness, and ventilation, and fevers will generally be found to prevail where these measures are not attended to. In a sea-side town like Madras there ought to be little indigenous malarial fever.

12. The next abstract shows the monthly prevalence of fever in 1881 :—

Months.				Fever Deaths.	Months.				Fever Deaths.
January	-	-	-	406	July	-	-	-	308
February	-	-	-	340	August	-	-	-	261
March	-	-	-	308	September	-	-	-	311
April	-	-	-	276	October	-	-	-	334
May	-	-	-	301	November	-	-	-	257
June	-	-	-	270	December	-	-	-	329

It would appear from these figures that in 1881 the fever mortality was little influenced by climatic causes, and that the local causes had remained tolerably constant throughout the year.

13. *Small-pox*—As already stated, there were 1,654 deaths from small-pox. The disease appeared in all the population groups, with few exceptions, but the amount of it varied greatly in different groups. Several escaped with three or four deaths; but in one village, Peddoo Naick's Pettah, there were 451 deaths among 65,629 people, or nearly 7 per 1,000.

The vaccination staff of the year consisted of the following officers :—

First-class Deputy Inspector	-	-	-	-	-	1
First-class vaccinators	-	-	-	-	-	4
Second-class vaccinators, males	-	-	-	-	-	10
Second-class vaccinators, females	-	-	-	-	-	10
Probationer	-	-	-	-	-	1
Peon	-	-	-	-	-	1

The year's vaccination work stood as follows :—

Births	-	-	-	-	-	15,476
Successful vaccinations under one year	-	-	-	-	-	8,456
Successful vaccinations from one and under six years	-	-	-	-	-	8,746
Successful vaccinations from six years and above	-	-	-	-	-	10,441

The total work at all ages during 1881 was,—

Total vaccinations	-	-	-	-	-	30,908
Of these successful	-	-	-	-	-	27,643
Unsuccessful	-	-	-	-	-	1,960
Unknown	-	-	-	-	-	1,305

About a tenth part of the population of Madras town was vaccinated in 1881.

14. The following abstract gives the monthly prevalence of small-pox :—

Months.				Small-pox Deaths.	Months.				Small-pox Deaths.
January	-	-	-	93	July	-	-	-	106
February	-	-	-	175	August	-	-	-	101
March	-	-	-	405	September	-	-	-	56
April	-	-	-	314	October	-	-	-	29
May	-	-	-	179	November	-	-	-	24
June	-	-	-	143	December	-	-	-	29

These figures show the presence of small-pox in an epidemic form.

There appears to be nothing further in the year's disease history calling for remark. The chief lesson which it conveys is that high death-rates in Madras are local, and that their causes must also be local and dealt with as such.

15. *Sanitary measures*.—In the present condition of the municipal finances, and until the question has been decided as to who is to pay for the necessary sanitary works, we would strongly advise that the chief reliance for warding off attacks of epidemics should be placed on conservancy. Much has already been done in this direction, but it is scarcely satisfactory to be told that "the permanent conservancy staff is very insufficient," and that it had to be added to when cholera was in town, and "very considerably in certain villages where cholera had been most fatal." This proceeding is wrong in principle. In a town of 400,000 people, without any provision for domestic drainage and water-supply, every part should be kept in a constant state of cleanliness. The worst of all times for cleansing is the time when cholera prevails, because any disturbance of filth heaps at such times is dangerous to the public health, and may lead to increase of cholera. We are told in this Report

that in the attacked villages "the latrine accommodation was extremely scanty, and what latrines " there were were in exceedingly close proximity to the wells from which their water was drawn." Some slight additions have been made to the latrine accommodation recently, and additional dust-bins have been provided, but the people in most localities have still to depend for water on wells dug in fouled subsoils, and a large staff of men, animals, and carts are employed to do the work, which, under a proper sanitary system, would be done by gravitation.

In 1881 the cost of all branches of conservancy was 21,980*l*. This includes the pay of 1,079 coolies, and the maintenance of 532 carts and four canal barges. The actual work done included the removal of 253,711 cartloads of rubbish and 20,000 tons of night-soil.

16. *Drainage*.—Nothing appears to have been decided about the general drainage of houses and localities. The black town surface drains were to be executed by a loan of 10,000*l* as a commencement. The most satisfactory statement in the report under the head of drainage works is the progress made in diverting the foul drains which have hitherto emptied into the Cooum. It was calculated that this work would be completed in another year, and a great nuisance and danger to the public health will in this way come to an end.

The main outlet drain to the sea, another source of nuisance, was also to be improved.

17. Six sewage farms were under cultivation during the year. The expenditure on them was 1,031*l*. and the receipts 897*l*. There must be something amiss in their management; either the sewage is unsuitable, or the farms require too much superintendence on account of limited area, or the crops are not those adapted to this kind of treatment.

18. *Water Supply*.—The quantity of water which flowed from Red Hills lake into the delivery channel was 4,839,592 cubic yards. The amount drawn off represents a consumption of 11½ gallons per day for 200,000 people, or half the population of Madras. Extension and improvement of the supply were both under consideration, but it would appear that the present amount would afford five gallons per head per diem for the whole population if the pipe service were extended, and in this way the necessity for using well water for drinking and culinary purposes might be avoided.

19. These are the chief practical points included in this report. There are details of work given, which show that much useful improvement was carried out in course of the year.

The great deficiency is, of course, the absence of drainage and water-supply to houses, and the condition of house compounds, to the frightful state of some of which only attention was called by the Sanitary Commissioner of Madras a year or two ago. On the evidence before us, it became our duty to represent very strongly to the Secretary of State for India in Council the flagrant apparent neglects from which such a state of things had arisen, even to the extent of raising a question whether the improvement of this large presidential city ought not to be taken out of the hands of the municipality.

In papers transmitted to the Army Sanitary Commission, with the present year's municipal report, a defence is set up against our attack. We have no desire to make any reply, and, so far as concerns the facts and their results to the public health, we have nothing to retract. The questions relate to facts and not opinions, and we accepted the facts as coming from quite trustworthy authority, while we pressed their inevitable results on the executive authorities. If the Madras municipality can do the work with or without additional powers or facilities, we shall be perfectly satisfied.

We are willing, at the same time, to give due weight to the revelations of the last census as to the condition of the population, but it should not be forgotten that ill health in times past may have played no unimportant part in leading to decay and impoverishment of the population, the last element, be it observed, being the one now pleaded by the municipality as a reason for not expending sufficient capital to enable them to put their great city in a sound sanitary state.

20. Whether, under the circumstances, the Government should lend a helping hand to the authorities to recover lost ground is not for us to say. Any way many years must elapse before the work is done, but, as we have already pointed out, the most needful of all work, namely, complete cleansing and keeping clean by the municipal executive of every street, alley, compound, and open space, and the removal of cattle outside inhabited limits, can be done with the existing municipal income, and this practically is the conclusion at which we must arrive from the data in this and in preceding Reports. But it in no way detracts from the opinions we have expressed as to the urgent need of combined works of drainage and water-supply for every village in the more dense portions of the city.

11th July 1883.



No. 14.

MEMORANDUM of the ARMY SANITARY COMMISSION on the REPORT of the BOMBAY MUNICIPALITY for 1881.

This Report is chiefly made up of municipal administrative details not coming within the scope of our remarks, and the principal points bearing on the sanitary condition of the city of Bombay are those contained in the report of the officer of health, to which we propose mainly to direct attention.

1. The population of the city at the census of 1872 was 644,405. The next census that of 1881, gave the population at 773,196, an increase in 10 years of 19·98 per cent. This latter enumeration revealed the startling fact that for every 100 females the city contained 150·68 males, although this proportion of males is lower by about 13 per cent. than the ratios of 1872.

The city contains now 128,791 more people than it lodged 10 years ago, and amongst the increase must be noted an influx of 17,775 low caste population, by which the number of this insanitary class has risen to 49,122, involving increased vigilance and expence on the part of the municipality or increase of mortality from epidemics.

2. The following abstract gives the classes of population, together with their numbers, in 1881, and their death-rates in the same year :—

Castes.	Census Numbers.	Deaths per 1,000.
Boodhists and Jains - - -	17,218	55·87
Brahmins - - -	35,428	19·05
Lingets - - -	1,167	37·70
Bhatias - - -	9,417	30·37
Hindoos of other castes - - -	407,717	27·24
Hindoo outcasts - - -	49,122	34·48
Mussulmans - - -	158,024	31·05
Parsees - - -	48,597	20·10
Jews - - -	8,321	24·99
Native Christians - - -	30,708	23·41
Indo-Europeans - - -	1,168	37·67
Europeans - - -	10,451	22·77
Negro Africans - - -	689	129·17
Chinese - - -	169	47·33
Total - - -	773,196	27·65

The death-rate calculated on the annual increment of population was thus 27·65 per 1,000. The registered deaths numbered 21,856.

3. The registered births were 16,638, equal to 21·51 per 1,000, evidently below the truth.

4. The next abstract gives the population in 1881 of each locality, together with the aggregate death-rates.

Localities.	Population, 1881.	Death-rates per 1,000.
Upper Colaba - - -	2,867	40·46
Middle Colaba - - -	14,265	24·18
Lower Colaba - - -		
Fort, Southern - - -		
Fort, Northern - - -	3,515	5·68
Esplanade - - -	33,822	22·20
Market - - -	13,080	22·78
Mandvee - - -	49,130	24·48
Chuckla - - -	42,351	32·93
Chumercary - - -	37,048	34·41
Dongree - - -	54,656	32·54
Dhobee Talao - - -	33,290	31·57
Funuswaree - - -	39,409	30·62
Bhuleshwur - - -	23,218	24·20
Khara Talao - - -	38,106	29·41
Coombarwara - - -	28,691	40·04
Khetwaree - - -	34,990	29·26
Girgaum - - -	29,436	24·96
Chowpatee - - -	25,319	27·64
Walkeshwur - - -	10,975	27·15
Mahaluxmee - - -	11,303	19·46
Mazagon - - -	6,232	22·30
Tarwaree - - -	27,904	21·82
Camateepoora - - -	14,542	18·56
Bycnlla - - -	64,658	36·17
Parell - - -	86,214	30·40
Seoree - - -	18,560	34·42
Seo - - -	5,555	35·10
Mahim - - -	17,237	18·21
Wurlee - - -	17,309	26·74
Water division - - -	14,621	16·34
	24,887	3·17

We have in this table the fundamental data from which the sanitary condition of every population group in Bombay can be deduced. It will be useful for future reference as from a well ascertained starting point. No doubt the ratios may rise and fall year by year all over the area but at all events, the facts as they stand may be accepted as sufficient for the purpose.

5. The following were the chief death causes for the year ending 31st December 1881 :—

Diseases.	Total Deaths.	Deaths per Cent. of Total Deaths.	Deaths per 1,000 of Population.
Small-pox - - - -	35	0·2	0·05
Measles - - - -	192	0·8	0·25
Enteric fever - - - -	11	0·1	8·82
Simple continued fever - - - -	400	1·7	
Ague - - - -	942	4·1	
Remittent fever - - - -	5,084	22·1	
Cholera - - - -	546	2·4	0·71
Diarrhoea - - - -	1,341	5·8	1·73
Dysentery - - - -	721	3·1	0·98
Respiratory diseases - - - -	3,799	16·5	4·91
All causes, exclusive of still-born -	21,856	100·00	27·65

In this enumeration of death causes the febrile group accounts for 28·0 per cent. of the total mortality of the year. On the other hand, cholera was quite a subordinate death cause.

6. Cholera first appeared in March, and yielded deaths afterwards in the following numbers :—

Months.	Deaths from Cholera.	Months.	Deaths from Cholera.
January - - - -	—	July - - - -	121
February - - - -	—	August - - - -	78
March - - - -	2	September - - - -	49
April - - - -	9	October - - - -	34
May - - - -	68	November - - - -	9
June - - - -	85	December - - - -	91

There were no cholera deaths in Upper Colaba, but all the other localities had a few deaths.

In the remaining 30 localities the cholera deaths-rates to population were under one per 1,000 except in five, in four of which the mortality was under two per 1,000, and the other, Funuswaree, with a population of 23,218, yielded 55 cholera deaths, equal to a death-rate of 2·36 per 1,000, the highest of the year.

7. In our memorandum on the Report of the Sanitary Commissioner of Bombay Presidency, we have quoted a table showing the past cholera history of Bombay city, and the great falling off in annual deaths from cholera, even in epidemic seasons, which has accompanied the work of sanitary improvement, particularly in the matter of conservancy. The experience of 1881 confirmed that of past years, and is introduced in the present Report by the following practical statement, which is of infinitely greater importance to public health and national interests than all quarantine requirements and disease theories. The officer of health says, "I would refer first to the great principle on which measures of precaution should be based; that principle, the teaching of our experience indicates, is cleanliness, in its widest sense; my experience in this year confirms the conviction and belief of former years, that the true line of precaution supplementary to personal vitality, wholesomeness and cleanliness, is cleanliness (soil purity, air purity, food and drink purity) in its widest sense. The more nearly sanitary precautions approach the standard of cleanliness, the more perfect."

8. We may just remark in passing that this principle laid down by the officer of health, as the result of his personal experience, is applicable to ships as well as to houses, and if it were fully applied in both cases, that is, if European nations would simply keep their seaport towns and houses in a proper state of cleanliness, and subject foul ships to sanitary cleansings in the same way as they ought to see to the cleansing of their ports, there would be no excuse whatever left for the quarantine doctrine, one of the objects of which is the protection of foul seaports at the expense of clean healthy ships, ignoring in this way the real sources of danger to the public health from all epidemics.

9. During the cholera of 1881, in Bombay, the remedies applied were cleansing, removing people out of affected houses, openings made for ventilation, including removal of tiles from roofs. Earthen floors were dug up and sprinkled with carbolic acid, and to such precautionary measures is no doubt due the low cholera mortality of the year.

10. The relation of cholera mortality to localizing causes may be briefly summarised as follows :—

Water sources.—Bombay has now a supply of pure water from the Vehar and Tulsi works, but part of the population is still dependent on wells of doubtful character. If it were of any use to press the evidence of facts as against vague etiological opinions the following data which are merely a repetition of facts observed in Bombay year after year, ought to have weight with those officers who still act on the idea that water is the main agent by which cholera is spread :—

Water Sources of Consumers.	Cholera.		
	Cases.	Deaths.	Per-centage of Deaths to Attacks.
Vehar and Tulsi - - -	542	421	77·67
Well water - - -	123	91	73·98
Not known - - -	38	34	89·47
Total - - -	703	546	—

These facts show that the pure municipal supply did not protect its consumers from cholera, for above 71 per cent. of the cholera deaths took place among them, while the table shows that the disease was more fatal among this class than among well-water drinkers.

The facts by no means show that the quality of water used by a community has no influence on the amount of cholera, for this relation has been quite sufficiently proved. They only show that impure water is not the sole cause of cholera, and further that if it were so any future improvement in cholera death-rates in Bombay would be impossible.

11. There are, however, other causes in operation (besides well-water for example) which would tend to increase predisposition to cholera attacks during epidemic periods. The officer of health has proved statistically that the great majority of deaths from cholera took place on ground floors of houses pointing to the influence of subsoil causes and deficient air movement. We shall return to this element subsequently; and he has also shown the existence of a direct ratio between the amount of cholera and the extent of house room, that is the effect of crowding. But while admitting the existence of these localizing causes of cholera, and also grave defects in drainage in many affected districts and in some close localities of cleansing also, it would scarcely be fair to pass over the question of improvement in the following statement of the officer of health. He says, "This year has been one of distinct progress—progress in continuous execution of sanitary works and progress in strength and grasp in sanitary control—and advance towards the accomplishment and realization of projects of vital and supreme importance to the public health."

But the Bombay of to-day is not the Bombay of the time when sanitary works were first undertaken. The population has been augmenting with great rapidity, so that Bombay, after London, is the most populous city in the whole Empire. One result of this progress is that work has to be done not only for protecting the public health, but to guard against the results of increasing density. The fact is of importance, because it proves the need of increasing activity on the part of executive sanitary authorities.

In the meantime the house drainage connexions are only in an experimental state, and the question as to the best form of domestic privies appears not to have been settled, but nevertheless a sum of 94,732l. had been voted provisionally for this important work. It is scarcely necessary to say that household water-supply must accompany house drainage, and that without this there can be no security for success.

12. The remarks of the officer of health on the necessity of pressing forwards with the works may be here quoted. He says, "The continuous execution of drainage sanitary works, progression in operations and measures for the improvement or amelioration of the public health or for the public convenience, has now become inevitable, and cannot be avoided."

"The sole responsibility arising out of the growth of the city is not confined to providing channels for the removal of the liquid refuse; when the drainage net work has been completed, the vital question of increasing the water-supply must be considered and discussed, and decided also; and there is no doubt that the water-supply with all appliances and measures recently adopted for improved and methodic distribution, is insufficient for the wants of the population at this time, and is still more insufficient prospectively." This form of the public health problem is not peculiar to Bombay. It has frequently occurred that town improvements have been the means not only of increasing the local population, but they have led to large increase by immigration. As the case stands Bombay has apparently a great future before it, but in the meantime details of drainage and water-supply have not been completed, and as one result of this state of matters, although there has been a large reduction in deaths from epidemics, the subsoil causes appear to remain. But besides this, increase of population carries with it increase of unhealthy conditions, and amongst these perhaps the most dangerous is surface overcrowding, which of itself intensifies all causes added by increase of population. It would appear, therefore, that the arrangements, area, and construction of future buildings, as well as diminution of crowding on present areas, must form an important part of the work of Bombay municipal government, for rooting out cholera, including of course conservancy, as the measure most immediately practicable, drainage, water-supply, and surface improvements generally.

13. It would appear that in local estimation Bombay will not become poorer by its extension, for a local writer, quoted by the officer of health, makes the following statement. After showing that the increase of population to houses had risen since 1872 from less than 21 to 25 individuals per house, he says, "During this time Calcutta has remained stationary, and Madras has actually lost in numbers, so that the increase in Bombay is all the more hopeful as to the extension of local

"industries and foreign trade, and the general prosperity of the city." This may be true, but the statistical data we have quoted of the relation of people to houses show at the same time the quarter from which danger to the prospective advance of the city may come. So long as public opinion in certain European countries accepts quarantine restrictions on commerce as an alternative to improving their own sanitary condition, Bombay will be at their mercy, unless the municipality makes the extirpation of local cholera one of its objects, and if it succeeds in this there will be nothing to fear from any other form of epidemic disease.

14. *Fevers*.—These, as elsewhere in India, are the most important death causes in Bombay. The abstracts already given show them to be of the usual types, but the peculiarity of Bombay fevers is the large preponderance of remittent fever. There were 11 deaths from enteric fever in 1881, 400 deaths from simple continued fever, 942 from ague, and no less than 5,084, or 22 per cent. of the total mortality of the year, was due to remittent fever.

The aggregate mortality from all fevers was 28 per cent. of the total year's deaths, but it only amounted after all to a death-rate to population of 8.32 per 1,000.

The health officer has given a table showing the annual fever deaths for 32 years, but the actual death-rates cannot be given because the population is not accurately known for the same years. During the earlier years of the series the annual fever deaths were from 6,000 to 8,000 a year, but in two years, 1864 and 1865, the fever deaths rose to 12,593 and 18,767 respectively. During the subsequent 11 years the fever deaths averaged from 5,000 to 6,000 in round numbers, but in 1877, the famine year, they suddenly rose to 12,832, and since then have been declining, the lowest being the 6,437 deaths of 1881. It seems doubtful if the population, including country immigrants, has altogether recovered the effects of the famine and scarcity years.

15. The prevalence of fever in different districts of Bombay shows striking differences in intensity. Thus in the "Water Division" the fever death-rate was only 1.40 per 1,000. In "Fort Southern" it was 2.27 per 1,000, from which point it rose to 5, 6, 7, 8, and 9 per 1,000. The highest rates of the year were 10.28 per 1,000 in Kara. Talao, 11.23 in Mandvee, 13.84 in Parell, and 18.72 in Sowree. There must have been some reasons for these great differences in fatality connected with the personal and sanitary relations of the people. It is not at all unlikely that in the most feverish localities most of the deaths have occurred in particular houses, and if the fact were so, the causes to be dealt with would at once be reached.

16. To show the importance of detailed inquiries into local conditions affecting the prevalence of epidemics, it will be better to introduce here the results of a distinct advance in this direction already alluded to, made by the health officer as regards the cholera of 1881, which shows the great influence of what may be called soil conditions on epidemic mortality.

Locality.	Cholera.	
	Cases.	Deaths.
Ground floor - - - -	515	391
First floor - - - -	111	90
Second floor - - - -	34	25
Third floor and above - - -	16	16
Unknown - - - -	11	9
Boat - - - -	16	15

The facts are not new, for they have been observed in the west also, but for the first time in India the health officer has been able to show that the same law prevails in India. What is further required is to apply the same principle of inquiry to fevers, and by this means a step in advance may be possible in dealing with its etiology.

It may almost be predicted that the amount of fatal fever bears a relation to the state of the subsoil. the ground area per head of the inhabitants, its drainage, surface cleansing, air movement, and the like. It is now known that cholera mortality has a close relation to the cleanliness of localities, and the same relation may be predicted of certain fever types, and perhaps in this direction may be found an adequate explanation of the great amount and fatality of remittents in Bombay.

These are merely suggestions which present themselves on considering the data in the present Report.

17. *Small-pox*.—There were only 35 deaths from small-pox in 1881, against 207 deaths in 1880. The quinquennial mean was represented by 1,035 deaths.

Bombay is under a method of vaccination with calf lymph, and the following were the year's results :—

	Vaccinations.			
Successful - - - -	-	-	-	17,276
Failed - - - -	-	-	-	1,111
Unknown - - - -	-	-	-	969
Total - - - -	-	-	-	<u>19,356</u>

				Re-vaccinations.
Successful	-	-	-	1,061
Failed	-	-	-	217
Unknown	-	-	-	52
Total				1,330

Successful vaccinations, according to age, stood as follows:—

Under one year	-	-	-	12,393
„ six years	-	-	-	4,386
Above „	-	-	-	497
Total				17,276

There were 16,638 births registered in 1881, so that the vaccinations under one year amounted to three-fourths of the births, but the total successful primary vaccinations exceeded the births.

Small-pox mortality was confined to 13 localities out of 31. The largest number, namely, 13 deaths, took place among 64,653 people in Camateepoora, one of the most unhealthy parts of Bombay.

The evidence in the present Report appears to show that vaccination is making head against births as well as against the small-pox deaths. But there will be less liability to small-pox as town improvements are carried out.

18. *Phthisis*.—For a number of years the relation of mortality from phthisis to local conditions has been a subject of inquiry in Bombay. In 1881 the deaths registered from this cause were 2,232, or 2·89 per 1,000 of the population.

Phthisis has been most prevalent in Kara Talao, a locality having 28,691 inhabitants, and a death-rate of 40·04 per 1,000, the highest of any populous district in Bombay. Its death-rate from phthisis for three years had been as follows:—

Years.					Ratios per 1,000 deaths to Population from Phthisis.
1879	-	-	-	-	8·29
1880	-	-	-	-	8·96
1881	-	-	-	-	6·41

and in each year the rate has been higher than prevailed in any other population group.

The place is densely built and peopled, and its population has increased 21·37 per cent. since 1872. In that year there were 8·40 square yards to each person, while in 1881 the area had fallen to 6·93 square yards for each, or 700 per acre, or 448,000 per square mile. The average population per room is 4·7 and its fever death-rate in 1881 was 10·28 per 1,000.

Kara Talao has old, badly planned underground drains, “square, imperfectly designed, imperfectly constructed; through the imperfections of design or construction, and time and age results, and altered building positions and street levels, or the imperfect, badly constructed, unsystematically or wrongly designed connexions, drains flow not now freely, their circulation is retarded or obstructed, or even regurgitation in some instances is observed. . . . There are many buildings occupied by the poorest classes, of the most unwholesome construction, so constructed that no vital improvement is possible except through demolitions.”

It is evident that this place presents a distinct sanitary problem. It is occupied by shoemakers and other outcasts, “terribly crowded, fearful mingling of human beings, hideous pollutions.” It besides contains the rest house for Moslem pilgrims. Other details are given which deserve careful consideration and prompt action, but the importance of the case lies in the fact that it is typical, and shows generally those local conditions which foster epidemics in Indian cities.

19. Before concluding the disease history of the year, we shall notice the following facts bearing on the cause of guinea worm. The village Gowaree “has been dreadfully affected with this scourge,” while villages on either side of it have been unaffected. The sanitary state of the villages is the same except in one particular. Gowaree has a foul well water supply, while the other villages use Vehar water. The obvious remedy is to fill up the wells and lay on Vehar water to the affected village.

20. We shall next give a brief abstract of sanitary works carried out in the course of 1881 under the usual heads.

Waterworks.—The most important work of the year was the addition of six feet to the height of the Tulsi lake dams at a cost of 5,800*l* with the view of increasing the storage by 480 millions of gallons. But in consequence of deficient rainfall the increase was only 234 millions.

Local rainfall appears to be decreasing, as is shown by the following data for Vehar area:—

					Rain, Inches.
1878	-	-	-	-	120·79
1879	-	-	-	-	76·4
1880	-	-	-	-	72·42
1881	-	-	-	-	59·10

Over the Tulsi area the rainfall in 1881 was 86·11 inches, against 93·76 inches in 1880.

The facts show the necessity of calculating areas of supplies on recurring periods of low rainfall.

The outdoor water-supply was effected by 54 dipping wells, 63 drinking fountains, 29 stand-pipes, 11 large ornamental fountains, 40 cattle troughs.

The house connexions had increased from 12,494 in 1880 to 12,817 in 1881.

Water was supplied by meter in 636 instances. The special waste prevention establishment appears to have done good work during the year. 106 mains, with a total length of 107,465 feet, were examined, of which 11 were found wasting water, three from old disconnected pipes, three from imperfect joints, and five from cracks. The total measured waste from these defects was 380,880 gallons per diem. Out of 2,254 stop-cocks examined 143 were found wasting by measure 190,320 gallons per diem. Out of 2,696 house connexions examined 1,941 were found wasting water.

The work had by no means been completed, but the actual waste was no less than 572,200 gallons per diem, or 23,800 gallons per hour.

The water saved would be sufficient at the present rate of distribution to supply about 100,000 people.

The new Bhandara reservoir was only making slow progress in the hands of the contractors, and local extension of the water-supply was much required in certain localities.

It appears to be doubtful whether considerable extension of water-supply may not be required to meet the necessities of drainage. In 1877 the water rate amounted to 31,377*l*. and in 1881 it had risen to 49,314*l*., showing rapid increase in the household and other consumption.

21. *Drainage*.—On the 1st June 1881, the new main sewer, 4½ miles in length, “was brought to a satisfactory completion. . . The outfall sewer was also completed.” Its end was injured by the sea, and 192 feet of the rubble and concrete covering of the pipes was displaced but repaired.

The foundations of the new pumping station had been completed, and the engineer anticipated that the engines would shortly be at work. About 16½ miles out of 23½ miles of pipe sewer had been laid. With the completion of main and outfall sewers the questions of local and house drainage were being considered as follows:—

- “1. The survey and estimates for house connexions in the first portion of the sewerage scheme.
- “2. The extension of the new sewerage system to Camateepoor with house connexions complete.
- “3. The interception of the present outfalls in Back Bay.
- “4. A new and comprehensive drainage scheme,” in connexion with a flood reservoir on the flats.

In reference to the drainage extension proceedings the Municipal Commissioner says, that “as soon as the new pumping station is ready for work, experimental house fittings will be connected with the new sewer, and as far as the sanctioned works are concerned, it now rests with the executive engineer to push them on with rapidity and efficiency.

“Meanwhile, there is an urgent necessity for a complete survey in order that any local works done may fit into the general design, and because the well-grounded complaints of the present state of the fort and other districts named make it impossible that the remedy should be long delayed.” The execution of house drainage connexions now rests with the municipality, and it is evident from facts stated in the present report that the proper execution and maintenance of these will be about as difficult a matter as the main drainage itself.

In 1872, house connexions were executed in one of the districts, Dhobi Talao, and the officer of health describes their then present state as follows:—“I believe they have not been repaired at any time since their construction; they are corroding and breaking, portable portions being abstracted, and unless they are restored or repaired they will not only not perform the office they were intended to perform but there will be no system of house connexions left in Dhobi Talao, and this section of the city, unless provided on another system, will be in a worse position than other portions of the city, for there will be a street exit for the sewage. Refuse waters are seen lying on the sides of many of the streets.” Dhobi Talao has a population of nearly 40,000, with a death-rate of 30·62 per 1,000. The question naturally recurs in this case, as in other similar ones, where does the responsibility lie? Is it with the administrative or with the executive authority?

The officer of health considers that it lies with the administrative, the municipality, for he says, “The moral to be derived from their condition is clear, that the duty of the municipality in house drainage does not cease with construction of house connexions, when house connexions are made, an equally important duty of constant supervision and repair remains.” There is no doubt on this point.

The execution and maintenance in efficient action of house connexions are, as matters of sanitary principle, a portion of the drainage system of a city, and the municipality should be held responsible, not only for execution, but for their being kept in working order.

Just as house drainage connexions without water are worthless for real sanitary work, so house connexions without supervision and repair become the means of actual injury to public health. Careful supervision, inspection, and repair will always be less costly in mere work than relaying drains from neglect of repairs altogether apart from risk to the public health.

An instance is mentioned of “one fine building” in the fort in which the house connexions were originally sound, “but time acted on them, they became old, they ceased to act perfectly, and foul gases escaped, rendering habitation of portions of the building loathsome, and of some portions impossible. . . . An active danger to be guarded against is the ingenious and confident plumber.”

In Nagdoure, a place where drainage is urgently required, there are 122 large cesspools receiving,

not only sewage, but surface and rain-water. As a consequence, the surface is sloppy and sometimes overflowed from cesspits.

Another evil, which we have often referred to, is the present method of removing surface water by covered drains, the cleansing of which leads to "breaking up lanes in drain clearing, destroys the continuity of surface, and removes the possibility of clean surface appearance; lanes which are constantly broken up can never look clean, in the unevenness created water will collect, and collecting, will become foul and form nuisances." In 1881 no less than 202·6 miles of these covered drains were opened and cleaned.

22. Enough has been said to show that the real work of draining Bombay has yet in great part to be undertaken, but it has only up to the present time been rendered possible by the completion of main drains and outfalls.

23. *Conservancy*.—This department of health has been the one most actively carried on in times past. The average strength of the service included 2,546 men and women, 415 scavenger carts, and 90 night-soil carts. In 1881 there were collected and removed 136,867 tons of garbage, or 5,300 tons more than in 1880. The average daily removal of night-soil was 233·6 tons, against 230 tons in 1880. It is satisfactory to see that cleansing is so actively carried on.

Part of the garbage is used for filling up and reclaiming the flats, and the Commissioner says that since the practice was adopted of covering the matter with a light coating of good earth no nuisance has been experienced. But it should be kept in mind that made ground of this nature is quite unsuitable for house building. As this manner of disposing of refuse must come to an end, the introduction of the method of incineration (which is a perfectly safe process if carefully done) has been under consideration.

24. The report shows that a large amount of very useful detail sanitary work was done in the course of the year, among which may be enumerated progressive improvement in construction and regulation of cattle sheds, regulation of unwholesome trades, prevention of nuisances, &c.

An attempt has been made in growing *eucalypti* on the Tardeo flats, and hitherto with some small appearance of success. The experiment is quite worthy of trial. In a former memorandum we gave some account of the methods of culture which had been successfully adopted in Algeria.

25. These appear to be the chief points calling for notice in the present year's Bombay report. They show that real progress is being made in rooting out the epidemic disease causes in the city, but that in some directions, especially as regards drainage, there appears to have been little done, when compared with the long time which has elapsed since the question of drainage was first under discussion.

It is satisfactory to learn that the outfalls have been completed, and that it is now possible to drain districts and houses, but past experience in these matters has clearly shown that current daily superintendence of works in execution, and subsequent careful supervision of the entire details of the drainage system, must form an essential part of these works. Water-supply will have to be increased, but no better illustration could be given of the true economy of daily oversight than has been exemplified by the results of water inspection, whereby, even at present, an amount of water has been saved sufficient for 100,000 people at the present supply rate. Let this same care be systematically applied to the drainage details, and a similar large economy in the cost of repairs will result.

We cannot conclude this analysis of the officer of health's excellent report without stating that the quarantine proceedings lately adopted at Suez against clean arrivals from Bombay were wholly unjustified by the year's sanitary history. These proceedings were based on no facts, and the adoption of them showed an apparent want of knowledge of the real causes of cholera.

12th July 1883.

No. 15.

MEMORANDUM of the ARMY SANITARY COMMISSION on the following PAPERS relating to the HEALTH of EUROPEAN TROOPS serving in MADRAS PRESIDENCY in 1881:—

1. HEALTH RETURNS of BRITISH TROOPS, together with a REPORT by the SURGEON-GENERAL, HER MAJESTY'S FORCES.
2. REPORT of SURGEON-GENERAL on the HEALTH of BRITISH TROOPS, together with HIS EXCELLENCY the COMMANDER-IN-CHIEF'S REMARKS thereon.
3. REPORT of SURGEON-GENERAL, HER MAJESTY'S FORCES on ENTERIC FEVER among BRITISH TROOPS in the MADRAS COMMAND, for 1881.

These three reports have been referred separately to the Commission, but as they all refer to the same subject, we shall discuss them together.

1. The average strength of British troops in 1881 was 10,389 non-commissioned officers and men, among whom there were—

	Per 1,000.
Admissions to hospital - - -	11,989 = 1154·
Deaths - - -	114 = 10·97
Invalids - - -	286 = 27·53
Average daily sick - - -	663 = 63·82

2. The following were the chief admission and death causes during the year :—

		Cases.	Deaths.
Cholera - - - -		33	18
Small-pox - - - -		9	1
Enteric fever - - - -		9	6
Intermittent fever - - - -		2,474	—
Remittent fever - - - -		51	1
Continued fever - - - -		371	1
Apoplexy - - - -		24	10
Delirium tremens - - - -		51	1
Dysentery - - - -		387	12
Diarrhoea - - - -		455	2
Hepatitis - - - -		401	16
Respiratory diseases - - - -		510	4
Heart disease - - - -		—	6
Phthisis pulmonalis - - - -		74	8
Anæmia and debility - - - -		—	1
Wounds and accidents - - - -		1,078	1
Venereal diseases - - - -		2,684	—
All other deaths - - - -		—	26

3. The reports themselves are chiefly of a departmental character, and several of the more important sanitary questions are included in the report of the Sanitary Commissioner for Madras Presidency, which we have discussed on other papers. There are, nevertheless, some facts which have an important bearing on the sanitary condition of Madras European army, which may be noticed in the paragraphs which follow.

4. Among these is the following abstract, in which the health of troops in 1881 is compared with corresponding data for the preceding 10 years :—

	Ratio per 1,000 Strength.	1871-80.	1881.
Admissions - - - -		1231·01	1154·01
Deaths - - - -		16·55	10·97
Invalids - - - -		41·09	27·58

By adding together the deaths and invalids it will be seen that the average 10 years' loss from both causes was 57·64 per 1,000, while in 1881 the loss was only 38·50, showing a saving of nearly 2 per cent. of the strength. Of course, this is only for one year, but the death-rate of 1881 includes 17 deaths from cholera against a single death during 1880.

5. Cholera.—The entire cholera mortality of the year took place at the following stations :—

	Stations.	Cholera cases.	Cholera Deaths.
Secunderabad - - - -		3	—
Kamptee - - - -		25	14
Thyetmyo in Burma - - - -		5	4

These figures are from Dr. Stephens' report, and contain one death more than the number given by the Surgeon-General. In Madras Presidency itself the whole cholera mortality of the year was *nil*. There were 14 deaths among Madras troops at Kamptee, in the Central Provinces, which the facts stated by the Sanitary Commissioner for the Presidency appear to show were due to flooding of surface and subsoil, and possibly to bad water, besides which the station itself is situated within the region in the Central Provinces where cholera was epidemic in 1881. The Thyetmyo cases took place in a well-known cholera endemic locality. In Madras Presidency itself there were 9,446 cholera deaths among the civil population; there were 22 deaths among Native troops, 12,485 in number, and 33 deaths among 10,332 prisoners in Madras jails. The only cholera among 6,442 British troops at the Presidency stations were three non-fatal cases at Secunderabad. It cannot be said that this comparative experience was other than satisfactory.

The purely local character of the Kamptee outbreak was shown by the cessation of cholera on movement of the troops.

6. Enteric Fever.—According to Dr. Stephens' tables there were nine cases and six deaths from enteric fever in 1881, including possibly a death out of hospital. The Surgeon-General's report gives nine cases and five deaths. The difference in this case is in an additional death at Thyetmyo (two deaths instead of one).

The facts as regards Madras Presidency stations were as follows:—

Stations.	Enteric Fever.	
	Cases.	Deaths.
Bangalore - - - -	2	2
Wellington - - - -	1	—
Secunderabad - - - -	2	—
Kamptee (Central Provinces) - - - -	1	1
Rangoon (Burma) - - - -	1	1
Thyetyo (Burma) - - - -	2	2
Total - - - -	9	6

At the three Madras stations there were thus only five cases of enteric fever, and the two deaths were yielded by one station, Bangalore. The proportions of cases at different stations vary from year to year. In 1880 there were 13 cases at Secunderabad and 10 at Kamptee.

In 1881, out of 879 soldiers' wives and 1,552 children, there was one non-fatal case of enteric fever in a woman. The milk consumers escaped the disease. There was one fatal case in a Native soldier at Secunderabad.

7. The Surgeon-General places the possible causes of predisposition to enteric fever in the following order:—

- Propagation by a specific poison in air, water, or food.
- Spontaneous generation by sewage emanations and putrefying organic matter.
- High temperature acting on young constitutions unaccustomed to such heat.

But then we have enteric fever occurring among Native troops in which the last of these causes can scarcely be assumed as sufficient, and hence, as Sir Anthony Home puts it, "the question is brought back to one of efficient conservancy, if it has really ever got adrift from this."

With reference to this view the Surgeon-General states that, in 6 out of the 9 cases of enteric fever recorded in 1881, the attacks could not be connected with insanitary conditions, but that in one case at Secunderabad the man had been sleeping near a latrine, and in another case at Thyetyo an adjacent cesspool might have been the cause. Up to the present time enteric fever among British troops in India has not been proved to result from any single cause. Statistical facts certainly point to a maximum of predisposition to attacks of this fatal fever being present among men of young ages, and of recent arrival in India. At this point the question of rapid change of climate, and its consequences to such subjects, must be admitted as of great importance. But we have also long experience at home and in other countries to prove that putrid emanations may lead up to fevers of this type. Much has been done in India at all stations to remove local causes of this class, but the great general cause, namely, malaria, remains, and we cannot better conclude this discussion than by inserting the following fever experience for the last 11 years in Madras Presidency. The figures and fractions are for annual average numbers, not ratios:—

Years.	Average Strength.	Simple Continued Fever.		Febricula.		Remittent Fever.		Ague.		Enteric Fever.		Total.		Ratio per 1,000 Strength.	
		Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.	Admission.	Died.
Average from 1871 to 1880.	11,032	831	4.1	491	—	176.8	3.3	1,413	0.1	39.3	13.9	2,952	21.4	267.6	1.94
1881 - - -	10,389	366	1	361	—	56	2	2,118	—	9	5	2,905	8	279.6	0.77

This table shows an increase over the average of ague of 700 admissions in 1881, but in all other fevers there has been a marked reduction in admissions. The general fever death-rate had also largely fallen off, especially as regards enteric fever, which nevertheless still occasioned five eighths of the fever deaths in 1881. Remittent fever had diminished in frequency and fatality, as had also continued fever. Looking at the facts generally they appear to show that, while the underlying malarial cause of fevers in India had remained much as usual, what may be called the aggravating causes which tend to determine the fever types, and consequently the mortality, had largely ceased to act at the stations.

These causes are all those connected with defects in drainage, conservancy, and water-supply, which we know from other reports have been actively dealt with at a number of stations, and the argument derived from the whole experience is that sanitary work has saved life and ought to be actively pursued, together with drainage, to lessen or remove malarial conditions. Sir Anthony Home's view, already cited, is therefore correct, and we may conclude by citing the following words of the Surgeon-General by way of practical application:—"In closing these remarks, it may be observed that it is not probable that any ordinary insanitary defects likely to have caused enteric fever have been overlooked, as the occurrences of a case is the signal for increased

"vigilance and extended inquiry. At the same time it must be stated that the men are exposed to one source of danger beyond control—I refer to the risk they run in frequenting offensive bazaars, and often eating and drinking there articles of the most unwholesome quality."

All this is no doubt true, but the question arises as to whether the time has not arrived for dealing with villages and bazaars in the vicinity of stations all over India. These places are a menace to the health of troops. Why should Wellington, situated in one of the healthiest climates in India, continue to furnish cases of enteric fever, and why should the Ulsoor tank at Bangalore still be permitted to risk the health of troops by its impure water collected from a foul gathering ground? In hot climates we must not always expect disease causes to assume the same apparent magnitude as they do in England before health is sacrificed. The vast importance of apparently trivial causes in India was long since pointed out by the Royal Commission on the Sanitary State of the Indian Army, and this principle must never be lost sight of in dealing with Indian sanitary problems.

8. *Venereal diseases*.—Admissions from this class of diseases amounted to 258·3 per 1,000 strength. The Surgeon-General states that the admissions under this head do not appear to be greatly influenced by lock hospitals, and no doubt the following explanation of this circumstance is correct. He says:—"This is due to the fact that the Contagious Diseases Act does not in any town reach more than a fraction of the women actually amenable to its control, and to the circumstance that clandestine prostitution is universally prevalent." This is the latest re-statement of causes of want of success in the operation of the Acts, and it merely repeats what has been said year after year.

The relation of the amount of venereal disease among troops to prevalence of clandestine prostitution has often been under consideration by the authorities in India, and various methods of dealing with the question have been tried, but hitherto without apparent advantage. The whole subject is, however, in the hands of the Government of India.

9. *Sanitary defects at stations*.—The chief complaint in the present report lies against the old Black Town drain at Madras, which discharges into the sea near the north-east angle of Fort St. George, and causes great nuisance to the occupants. "But the municipality are apparently taking steps to relieve the residents of the Fort of the offensive odour." The Fort drain is also at times offensive. Both these nuisances are perfectly gratuitous, and we can only express surprise that they still exist.

10. The following improvements are enumerated in the Commander-in-Chief's letter:—

The new Royal Artillery barracks sanctioned for St. Thomas' Mount have been commenced.

The new Artillery barracks at Trimulgherry are very nearly completed, and the men would have been moved into them from the old bad bomb-proof barracks by the end of the year.

The barracks at Tonghoo, which had been damaged by a storm, were under repair, at a cost of 3,500*l*.

Hospitals at Kamptee, Rangoon, and Tonghoo were to be proceeded with when funds were obtained.

Masonry drains were provided for bath rooms and wash-houses of the Royal Artillery Barracks, Trimulgherry.

Steps were being taken to improve the water-supply of Madras Hospital.

The Surgeon-General reports that latrines are generally constructed on the dry-earth system, and are fairly attended to.

Lastly. Although the present report is chiefly statistical in its character, it contains evidence of sanitary work having been successfully done in past years, and the result has apparently been a very considerable improvement in the health of troops for the year 1881. In a country like India, however, with its tendency to epidemic outbreaks, the real test of improvement must be sought in comparing the ratios of mortality from epidemic diseases of troops and civil populations in their vicinity, during epidemic years. Again, the year's experience, like that of many others, proves that apparently high epidemic death-rates may really be due to particular stations, showing that it is on these stations that sanitary effort should be spent. If Kamptee, for instance, in the Central Provinces cannot be improved, the question naturally arises whether it should be occupied at the sacrifice of a large loss from epidemics. The site appears to be unfavourable.

But, as a whole, the year's loss from epidemics has been small, and the real loss has been inefficiency from prevalence of malarial fevers, the causes of which in most cases are purely local, and, as such, admit of mitigation by known engineering measures. The application of these, together with what the Surgeon-General so well names "increased vigilance" in dealing with defects in conservancy, are the practical lessons of the present year's report.

11th July 1883.

No. 16.

MEMORANDUM of the ARMY SANITARY COMMISSION on the MEDICAL HISTORY of the EUROPEAN TROOPS in the BOMBAY COMMAND for 1881.

1. The trooping service during the year 1881-82 was carried out from England and Natal to Bombay by the usual troop-ships assisted by two hired transports. There were in all 13 outward voyages, and in the course of the season there were embarked the following numbers for India :—

Officers	-	-	-	-	688
Ladies	-	-	-	-	134
Children	-	-	-	-	141
Men in health	-	-	-	-	9,988
Women in health	-	-	-	-	358
Children in health	-	-	-	-	441
Female servants	-	-	-	-	25

Of these outward voyages three commenced from Natal.

2. Out of these strengths of men there were 765 admissions to hospital, and three deaths, one from rheumatism, and two from pneumonia. Among the admissions there were from—

Primary syphilis	-	145	=	180·3	per 1,000
Secondary syphilis	-	18	=	22·4	"
Gonorrhœa and its results	-	157	=	195·2	"
Total	-	320	=	397·9	"

Admissions under these heads formed no less than 37·2 per cent. of the total admissions. At the conclusion of the voyages 31 cases of primary syphilis were transferred to hospital on arrival at Bombay.

This renewed experience of 1881-82 has called forth the following remarks from the Surgeon-General, who says that "in some cases it is quite possible the disease may not have manifested itself until after the troop ship had proceeded to sea, but there is little doubt that many might have been detected by efficient inspection prior to embarkation."

It is necessary, however, to repeat here that in reply to a similar complaint in the preceding year, the Army Medical Department stated that "not a single man suffering from these complaints was embarked for India."

3. We must further call attention to the fact that 56 cases of itch appeared on board.

4. Among children there were four deaths from diarrhœa and one from bronchitis.

5. Of the total number of officers and men embarked for India, 423 officers and 7,445 men left at dates which would enable all to arrive in India before the hot weather, but most of them in the cool season. The first departure from England was on the 19th October, the last on the 13th April.

6. On the return voyages from India the embarkations at Bombay were as follow :—

Officers	-	-	-	-	466
Ladies	-	-	-	-	132
Children	-	-	-	-	207
Men in health	-	-	-	-	7,499
Women	-	-	-	-	505
Children	-	-	-	-	1,179
Invalids, men	-	-	-	-	1,860
Women	-	-	-	-	142
Children	-	-	-	-	348
Insanes	-	-	-	-	83
Convicts and bad characters	-	-	-	-	176

The dates of departure from Bombay show that the greater number of invalids would arrive in England in the mild season.

With the single exception of the occurrence of venereal diseases on board, the facts as regards health of troops show that the service of the year was well performed.

7. The following are the principal data connected with the sanitary state of European troops in Bombay Presidency in 1881 :—

Strength	-	9,986	
Admissions	-	17,156	= 1718·0 per 1,000
Deaths	-	127	= 12·72 "
Constantly sick	-	673	= 67·38 "

The admissions and deaths when compared with the previous ten years' averages, which were respectively 1,565·1 and 17·01 per 1,000, show a considerable increase of sickness and a large reduction in the death-rate. The constantly sick were 56·81 per 1,000 during the same ten years, against 67·38 for the year under review, but these ten years included the Afghan war, in which part of the Bombay army was engaged, and suffered accordingly, as may be seen from the average rates for 1879-80, which were as follow :—

Admissions	-	-	-	2,125·9	per 1,000
Constantly sick	-	-	-	72·46	"
Deaths	-	-	-	20·72	"

The Bombay European army had apparently not recovered from the effects of field service at the latest dates.

According to Dr. Stephens' statistical tables appended to Dr. Cunningham's report for 1881, the strength of the Bombay European army, exclusive of troops serving in Afghanistan, was 9,895, and the following abstract gives the admissions and deaths from the chief disease causes among this number in 1881 :—

Diseases.	Cases.	Deaths.	
		Total.	Per 1,000.
Cholera - - - - -	6	3	0·30
Enteric Fever - - - - -	42	28	2·83
Intermittent - - - - -	7,465	—	—
Remittent - - - - -	302	9	0·91
Continued - - - - -	551	—	—
Apoplexy - - - - -	27	12	1·21
Delirium tremens - - - - -	31	—	—
Dysentery - - - - -	232	18	1·83
Diarrhoea - - - - -	564	8	0·30
Hepatitis - - - - -	285	15	1·52
Spleen disease - - - - -	66	1	0·1
Respiratory and phthisis - - - - -	993	14	1·42
Rheumatism - - - - -	392	—	—
Veneral diseases - - - - -	2,586	—	—
Wounds and accidents - - - - -	1,050	—	—
All other causes - - - - -	3,060	30	2·42

The deaths in this list include three suicides and two deaths out of hospital, not included apparently in the Surgeon-General's table, which gives the hospital deaths only.

9. The cholera cases took place, two at Ahmedabad, two at Baroda, and two at Poona and Kirkee, and there was one death in each locality. The total cholera death-rate was 0·30 per 1,000, which may be compared with the rate among the civil population of Bombay Presidency, viz., 1·01 per 1,000 and that among native troops, which was 1·35 per 1,000.

10. The most important fever death cause of the year, enteric fever, furnished, according to the Surgeon-General's table, 34 admissions and 19 deaths, at the following stations :—

Stations.	Cases.	Deaths.
Aden - - - - -	2	2
Karachi - - - - -	1	—
Hyderabad - - - - -	1	—
Poona - - - - -	13	7
Ahmednagar - - - - -	2	1
Deesa - - - - -	2	1
Mhow - - - - -	6	4
Nusseerabad - - - - -	6	3
Taragarh - - - - -	1	1
Total - - - - -	34	19

It will be seen that there is a discrepancy in the figures between the two tables, and when the station return in Dr. Stephens' statistics is compared with that given by the Surgeon-General, the following differences present themselves :—

—	Cases.	Deaths.
Mhow - - - - -	5	4
Karachi and Ghizree - - - - -	7	6
Poona and Kirkee - - - - -	16	10

The localization of enteric fever, according to Dr. Stephens' list, therefore stands as follows :—

Stations.	Strength.	Enteric Fever.	
		Cases.	Deaths.
Nusseerabad - - - - -	637	6	3
Mhow - - - - -	1,427	5	4
Deesa - - - - -	225	2	1
Karachi and Ghizree - - - - -	679	7	6
Hyderabad - - - - -	883	1	—
Aden - - - - -	758	2	2
Ahmednagar - - - - -	441	2	1
Poona and Kirkee - - - - -	1,917	16	10
Taragarh - - - - -	48	1	1
Total - - - - -	—	42	28

These discrepancies, no doubt, admit of explanation, but we must accept the figures as showing the comparative liability of stations to enteric fever in 1881.

In the reports on the stations there are no facts mentioned which would account for the varying amount of enteric fever at them, but, as we shall see, there are conditions of a general nature present which might predispose troops to fever attacks without reference to type.

11. The most important admission cause of the year was malarial fever, the liability to which for three consecutive years at all the stations is well shown in this table prepared by the Surgeon-General :—

Stations.	Admissions per 1,000 Strength from Malarial Fevers.		
	1879.	1880.	1881.
Bombay - - - -	601·8	506·3	456·4
Deolali - - - -	1281·0	641·7	539·5
Belgaum - - - -	578·7	368·5	650·8
Aden - - - -	83·6	528·9	125·8
Karachi and Ghizree - - -	1664·4	1784·3	667·6
Hyderabad - - - -	1201·0	932·9	849·7
Sukkur - - - -	—	500·0	1000·0
Poona - - - -	1202·3	1037·6	527·3
Kirkee - - - -	1248·5	899·5	396·0
Ahmednagar - - - -	1207·8	1271·4	541·8
Satara - - - -	1479·7	489·9	110·4
Kolapur - - - -	—	—	754·4
Purandhar - - - -	1253·9	698·8	716·8
Khandala - - - -	631·6	1113·6	1101·4
Mhow - - - -	1451·6	1371·8	802·1
Indore - - - -	1532·5	1715·9	608·7
Asirgarh - - - -	1475·7	1686·4	871·0
Neemuch - - - -	3207·8	1817·9	1125·6
Nusseerabad - - - -	1327·2	447·2	758·4
Deesa - - - -	334·9	1135·3	902·4
Ahmedabad - - - -	984·5	1053·8	558·6
Baroda - - - -	2078·2	2262·6	1522·4
Taragarh - - - -	1973·7	1363·6	560·0
Mount Aboo - - - -	1437·5	1318·8	2871·0
Tithal - - - -	—	125·0	250·0
On march - - - -	179·4	248·1	790·1

One satisfactory point in this table is that it shows a very considerable reduction in fever liability in 1881, at most stations. It shows that certain stations have fever-rates persistently higher than others, and of these Mount Aboo, Baroda, Neemuch, Mhow, Asirgarh, and Indore require to be improved. As often happens, troops on march suffer less from fever than troops at stations, and the three years' experience appears to point to the existence of purely local fever causes, probably modified by local climates and topography.

12. We shall next abstract briefly the information in this Report on the condition of stations, as it contains points of some importance.

Much discussion has arisen as to the causes of fever among troops at Colaba, Bombay, and if the fever statistics can be trusted, we have got a step nearer to the cause. The Surgeon-General states that there are two assumed causes of fever at this station,—(1.) An extensive mangrove swamp to windward. (2.) Damp subsoil and generally inferior infantry barracks. "The new Artillery barracks," he says, "with one exception, stand on comparatively high ground, while the old infantry barracks are situated on low-lying land to the north-west of the road, and between this and Back Bay mangrove swamp. . . . The water-logged condition of the ground on which the infantry barracks stand is a well-known fact. During the rainy season, indeed, it is little better than a swamp, while its physical conformation is exactly calculated to cause the retention of subsoil water." Besides being on higher ground, the Artillery barracks "are raised on high solid stone plinths; they are dry, lofty, and well ventilated. The plinths of the Infantry barracks, on the other hand, are barely raised above the surface of the ground, they scarcely deserve the name of plinths, the floors are necessarily damp, and the rooms are low and dark." There is, however, one block of the Artillery barracks which stands on lower ground than the other five. The following is the proof of the influence of local position and bad barracks on fever prevalence,—the infantry suffer more from fever than the artillery, and the lower block of the Artillery barracks has more fever proportionately than the five which are better placed; and then as regards the mangrove swamp, it is argued that these facts and the amount of fever at certain seasons tend to show that the swamp has not been the cause of the fever attacks at Colaba. It may be asked, on the other hand, whence comes the fever in the Artillery barracks? The Surgeon-General has shown ample cause for fever prevalence being greater in the Infantry barracks, but the facts scarcely show that the swamp has nothing to do with it. It is satisfactory to learn from the papers that new barracks will be built.

13. This station affords a curious illustration of the substitution of one sanitary defect for another.

It appears that the Sanitary Commissioner had advised the filling up of cesspits which formerly received the refuse water, and recommended that the water should be drained away instead. Now some 18 years ago we had laid down in our "Suggestions" that work of this kind was to be carried

out either by pipe drains or by surface drains, formed of impervious material. In the Colaba case the cesspits were very properly abolished, but it cannot be said that dry rubble gutters from which the refuse water "soon soaks into the ground" was any improvement on the former practice. We must refer to the last edition of our Suggestions of 1882 for the principles on which work of this kind should be carried out.

The hospital at Colaba appears to be no better than the Infantry barracks, but it is some satisfaction to be informed that a new hospital will be built when the barracks are reconstructed.

14. *Aden*.—In our Memorandum on the Report of the Sanitary Commissioner with the Government of India, we have quoted from Surgeon-General Gilborne's report the account given of the Somali villages at Aden in relation to the occurrence of cholera among the people after the arrival of the "Columbian" from Bombay, and the consequent imposition of quarantine at Suez. We shall only here refer to the facts in their relation to the sanitary state of the garrison. One village, Maala, is described as "the place where contagious maladies usually originate, and to which they 'cling longest,' and the Deputy Surgeon-General considers this village to be "a standing menace to the health of the garrison." In Colonel Pottenger's letter on this report it is stated that "the condition of affairs at the village of Maala had undergone a radical change." It had been apparently mostly removed (date 14th October 1882). Another objectionable feature, namely, a mud bank at Front Bay, could, it is stated, be easily removed. The only remark which appears to be called for is, that in such a position as Aden occupies scrupulous attention should be bestowed on all these matters, as they involve not only the health of troops, but the interests of the great commercial marine which touches at Aden. Such a thing as the outbreak of cholera and bowel diseases among the Somalis ought not to have occurred, and in such an isolated locality the object of sanitary work ought to be to eradicate every unhealthy corner where zymotic disease might find a resting place.

15. *Karachi*.—In our remarks on the Report of the Sanitary Commissioner for Bombay, we have discussed the local conditions which in times past have made Karachi one of the most feverish localities anywhere. The most obvious cause is the universally recognized presence of a large swamp to windward. The Surgeon-General doubts the paramount influence of this swamp, but he states other important local causes which have several times been brought to notice; such are, "subsoil dampness, sudden depressions of temperature, excessive barrack ventilation, inattention to personal hygiene, night duties, indifferent drinking water, and immature soldiers. The Sudder bazaar, which is close at hand, is in a decidedly insanitary condition; it contains a large number of cesspools, and altogether must be regarded as an additional source of danger to the health of troops."

Some of these disease causes cannot be altered, but a damp feverish locality to leeward of a large swamp, where troops have year after year suffered intensely from fever, appears to suggest the removal of as many men as possible to Ghizree as a matter for earnest consideration. A few wooden huts well raised above the ground there, with free ventilation below the floors, would soon enable the Karachi fever question to be settled. The Surgeon-General states, that men whose health has suffered at Karachi as a rule quickly improve in health and strength at Ghizree. Then why should it be necessary to injure the men at Karachi before sending them to Ghizree?

16. *Poona*.—The present report contributes a further part of the sanitary history of Ghorpuri barracks as follows:—"The persistent and excessive unhealthiness of the Ghorpuri barracks has at length led to their being abandoned, for a time at least." The 1st Battalion Rifle Brigade was so weakened during seven months' occupation from the effects of malaria that they had to be sent to Wanowri, Kirkee, and Ahmednagar. The result was "most satisfactory," "in an incredibly short time the men shook off the tendency to ague, and the number of sick fell to just one half, thus proving conclusively that the unhealthiness of Ghorpuri barracks is due essentially to local causes."

We discussed the sanitary problems connected with these barracks so fully in last year's memorandum on the Surgeon-General's report, that it will be sufficient to quote the following confirmatory statements about them from the report under review. Subsoil dampness, he says, does not exist at Ghorpuri to the extent of water-logging the subsoil, "but in the form of damp foundations and floors. The facts that the floors of the old barracks are only just raised above ground level and have drains underneath, which latter, although meant for carrying off waste water, are little better than receptacles for filth, speak for themselves. Occasionally, too, the locality and its buildings are seen in the early morning to be shrouded in fog, a circumstance which points clearly not only to damp and chill air but to damp earth. The site too is low, and the Officers' quarters and patcheries stand on black cotton soil, which is well known to be retentive of moisture. We have here most of the conditions of a malarious locality. We have damp, and its concomitant chill, while the barracks are so constructed as to allow these two disease producing causes the utmost free play." The practical result of the whole discussion is a proposal by the Government of Bombay to abandon these badly placed, badly constructed barracks, and to erect new Infantry barracks at Kirkee; and we only hope that, on the facts of the case, which year after year have been so clearly stated by medical officers, this proposal may be carried out, unless the decision of the Government of India to leave the barracks unoccupied for several years, to remove the recognized defects, and then to occupy them tentatively, should be attended with success.

17. *Mhow*.—The following statement is of importance:—"The ground immediately to the south-west of the Infantry barracks, which becomes a marsh in the rainy season, and is supposed to be

" the chief source of the malarious fevers from which the Infantry at Mhow suffer so much, has been drained and planted with trees. It will be instructive to observe whether this measure is followed by any permanent reduction in the number of admissions from fever amongst troops quartered in the barracks in question." We quite concur in this view. The facts could no doubt be obtained year by year from the admission records.

18. *Neemuch*.—No further facts have been obtained to show why this once healthy station should have become one of the most feverish in India. In a former memorandum we called attention to damp undrained ground to windward and to open nullahs as probable causes. It is clear that there must be a local cause.

19. *Nusseerabad*.—Statements of various contradictory kinds have been made about this station. Insanitary locality has been affirmed and denied as a cause of fevers there. But we are disposed to accept the following account of the Surgeon-General as part at least of the facts of the case. He says, "The cantonment is situated on ground slightly elevated above the surrounding flat sandy district. The drainage should be naturally good, but it seems that in the rainy season the surface drains are unable to carry off the water properly. Much of it is thus allowed to sink into the ground. An improved system of surface drainage would therefore appear to be necessary." But on the other hand the Executive Engineer says that he considers the surface drainage of the lines occupied by British and Native troops, and also of the officers lines, at this station is as perfect almost as it can be made. He denies that water accumulates after rain. It disappears into the subsoil an hour after rain, and any obstructions of surface drains are cleared away. The only questions we can ask are these: May not the malaria producing cause lie in the absorbent subsoil itself, and may not this be a case where subsoil drainage would afford the required remedy? The question of water-supply at this station has been discussed on other papers.

20. *Baroda*.—This station was occupied in 1881 by a small garrison, only 206 men, from among whom there were 478 admissions from fever. The fever-rate was 2320·4 per 1,000, out of a total admission-rate of 3936·9 per 1,000. The Surgeon-General states the local fever causes as follows:— "Insufficient surface drainage, old and ill-constructed barracks, the floors of which are on a level with the ground. Surface of cantonment flat, with a porous soil and impermeable subsoil. During the rainy season the surface drains are altogether unequal to the removal of the water, which accordingly collects in pools, and eventually soaks into the ground." The barracks have been condemned, but cannot be replaced at present for financial reasons. This much, however, may be safely predicted of any future barracks, that unless a better site be obtained or the cantonment is thoroughly under-drained, no amount of new barrack building will keep off fever. And this consideration leads to a suggestion that the effect on the site of thorough subsoil drainage might possibly be tried at once. It would not cost much, and if the work were well done and successful it would come into use also when the new barracks can be built.

21. These are the chief points connected with stations of British troops which appear to call for remark.

They do not include other instances in which improvements are advised by the Surgeon-General. These appear to have been dealt with as far as practicable, and it is evident that the authorities have been desirous of acting on the advice of their officer so far as they had means at their disposal.

We shall next introduce a few remarks on diseases connected with the personal habits of the men, beginning with—

22. *Venereal Diseases*.—As already stated, there were 2,586 admissions under this head, equal to 261·3 per 1,000, which was a shade above the average for the whole Indian Army, namely, 260·5 per 1,000. The Bengal admission-rate was 275·8, and the Madras rate 258·3. The Surgeon-General considers that the ratio for Bombay might be lowered if lock hospitals were opened at every station, efficient police supervision "largely increased," and the area of the Acts extended, so as to bring neighbouring villages under the Acts. We have stated what appear to us to have been the statistical results of similar measures all over India on other papers, and it is unnecessary to discuss the subject further. But as the Surgeon-General has advocated their extension at Bombay stations, it may enable some opinion to be formed of their probable efficacy if we give the admission-rates for the Bombay European army under the operation of the Acts, as follows:—

Years.			Venereal Admissions per 1,000 Strength.	Years.			Venereal Admissions per 1,000 Strength.
1870	-	-	184	1876	-	-	179·6
1871	-	-	160	1877	-	-	197·3
1872	-	-	148	1878	-	-	216·4
1873	-	-	179	1879	-	-	258·9
1874	-	-	164	1880	-	-	256·8
1875	-	-	165	1881	-	-	261·3

These are the results of 12 years' application of the Acts.

23. *Intemperate Habits*.—These, as is well known, are fostered by the present canteen system under which, as stated by the Quartermaster-General, Bombay, and quoted by us last year, the young soldier is "taught to drink spirits." The Surgeon-General, on the other hand, reproduces an

old argument, which was disposed of nearly 20 years ago by the Royal Commission, that it is better to provide good rum at the canteens to keep the soldier from providing himself with bad liquor elsewhere. We are very glad, however, to find that the Surgeon-General prefers light wine or light beer for canteens, and that he objects to porter as too heavy for the climate. This reform with the abolition of spirits in canteens and bazaars, as advised by the Royal Commission, would meet the case completely, and nothing less should be aimed at.

24. *Diet*.—It has been long known that the dieting of troops in India was carried out without due regard to the requirements of health. The subject was fully discussed in our memorandum on last year's Bombay report, with special reference to representations made on the subject by the Government of Bombay.

The present practice is described by the Surgeon-General, as follows:—"Breakfast at 8.30, dinner at 2.30, and tea immediately after evening parade. In many cases the soldier partakes of no solid food from dinner time one day to breakfast the next morning, and in the interval may have to go through night duty or morning parade. . . . It is a matter of common experience that exposure to night air in this country is a fruitful source of malarious attacks, and there is little doubt that an empty stomach lessens considerably the power of resisting the malarious influence." He advocates an early meal of cocoa and biscuit, and states that improved health followed its adoption in the North Staffordshire Regiment at Kurachi last year. What is really required is a readjustment of the ration scale both as to articles and daily distribution.

We have often discussed the subject, and cited the experience of the French Army in Algeria, in which the ration is divided on physiological principles, and with excellent results as regards health. But there are certain additional points raised in a letter of the Adjutant-General in a Government letter (Bombay Castle, 11th January 1883, Military Department, No. 166), which require notice. After reciting the present ration, he says, "It should be borne in mind that in former days, that is, before the introduction of the short service system, it was the exception to find a growing lad in the ranks in India, and as the old soldier did not require so much nourishment as his younger comrade, the ration taken as a whole was sufficient for the wants of a 'troop or company.' But it is found to be insufficient, more especially in these days of young soldiers. The remedy must therefore be sought for in an increased quantity of food, and his Excellency the Commander-in-Chief concurs with the Surgeon-General in considering such increase absolutely necessary in order to secure four meals a day to the European soldier in India."

Now that the question has been officially raised it might be well to settle it once for all. The military and medical authorities in India could do this without difficulty. We would only state one or two obvious principles to be kept in view, as these were brought out by the Royal Commission of 1863:—

1st. There should be a morning meal before early parade. The best of all meals for the purpose would be well made coffee with bread broken up in it, and eaten with a spoon, as is done by French soldiers.

This practice was stated by the Conseil de Santé of the French Army to the Commission sent to Algeria by the Marquis of Ripon in 1865-66, as an important cause of improved health of the army there.

2nd. Again, is it not contrary to physiological law to give the soldier the heaviest meal of the day at 2.30, before the setting in of the heat, when he least requires it? And would it not be better to divide this meal so that part might be eaten in the afternoon?

3rd. It is clear that where night duty has to be undertaken there should be a meal of some kind consumed before it is entered on.

Lastly, if any increase in the amount of food is to be made, it may be suggested that the addition should take place in the vegetable and farinaceous elements.

25. Under the head of *General Remarks* the Surgeon-General has discussed the various influences connected with stations, barracks, habits of men, inexperience of young soldiers, of the precautions required in Indian climates, &c., in their several bearings on the health and efficiency of the Bombay European Army. The whole of these remarks deserve the careful consideration of military and administrative authorities. Within a short compass many important principles will be found discussed, and the whole forms a fitting conclusion to this interesting and useful Report.

12th July 1883.

No. 17.

MEMORANDUM of the ARMY SANITARY COMMISSION ON REPORTS of FAIRS and FESTIVALS held in MADRAS PRESIDENCY in the latter part of 1881 and in 1882.

1. These papers give in a very brief and not altogether satisfactory form, the dates, attendance, and consequences to health of 33 fairs and festivals held in districts of Madras Presidency, seven of which only took place in 1881, and the remaining 26 took place in 1882, in regard to which year we have no account as yet of cholera in Madras, and it is therefore impossible to estimate the relation of health of pilgrims to that of the surrounding civil population. The data in regard to the seven festivals held in 1881 may be stated as follows:—

2. *Tirupati*, in North Arcot district. This festival was held between the 25th September and 4th October 1881 on a hill beyond the jurisdiction of the Madras sanitary authorities.

The water-supply was "very bad," a foul tank was used for all purposes. No suitable sanitary precautions were in force. The sacred food sold to pilgrims was "unfit for human consumption." No case of cholera ascended the hill, but three cases were treated among pilgrims who had been there, the first on 6th October, as stated by the hospital assistant. Between 3rd October and 31st December there were 494 cholera deaths in North Arcot.

Under the insanitary conditions stated, it is not matter of surprise that pilgrims suffered. Between the same dates cholera prevailed more or less in 15 out of 18 districts in the Presidency. There were 12,000 pilgrims present at the festival, and there was no proof that they spread cholera any more than that it was spread by other people. North Arcot yielded some of the deaths due to the second cholera outbreak of the year a few days earlier than other districts; this is all that the facts teach us.

2. *Subbramanya* festival was held between 20th and 28th November 1881 in South Canara, in which there were 77 cholera deaths in November and December. There were 2,500 people present. Sanitary precautions were adopted, and there was no cholera at the festival.

3. *Dharmastala* festival was held between 14th and 24th November, also in South Canara. Water-supply was guarded and latrines and trenches provided, nothing is said about cleanliness; 10,000 people attended, and after the fair was over there were three cases of cholera.

4. *Guruvayur* festival, Malabar district, 15,000 people attended. Sanitary precautions were adopted, and there was no cholera. There were only 19 cholera deaths in Malabar.

5. *Kolur*, in the same district, was attended by 20,000 people; similar precautions were adopted and there was no cholera.

6. *Sriringam* festival was held in Trichinopoly district, between 21st of December 1881 and 10th January 1882, and in this district between 19th October and 31st December 1881 there were 1,804 deaths from cholera.

Sriringam town has a population of 18,665. The number of pilgrims is not stated, the usual sanitary measures carried out in the town were enforced. Between the 11th November and 30th December there were 24 deaths in the town from cholera, 12 of which took place during the festival, but there are no data to enable the relation of the pilgrimage to cholera to be traced.

7. *Chidambaram* festival in South Arcot was attended by 5,000 pilgrims. It was held in December. Dates not given. Between 15th February and 31st December there were 136 deaths from cholera in the district. In Chidambaram, town with 15,518 inhabitants, there were 27 cholera deaths between July 11th and 31st December, but there is no information to show the relation of these deaths to the 5,000 persons added to the population.

8. The main sanitary feature presented by these festivals is the addition of a certain number of persons to an already existing susceptible town population, living under the management of local boards, and the problem presented by them is simply whether the usual municipal procedure could afford sufficient protection during cholera periods such as that which existed in the end of 1881. It is easy to see what might have been the result if, under such conditions, 50,000 people had entered these small towns instead of 5,000. The practical lesson appears to be that camping outside and away from the crowded town populations should be the rule, and that considerable increase of the conservancy staff and arrangements should be made.

9. As we have no means of comparing the cholera prevalence of 1882 with the experience of festivals during the same year, we shall simply give the general results for the 26 festivals held during this year. In some points these are interesting and instructive. The numbers present are not stated for three festivals. But for 23 the pilgrims present numbered 563,000. The whole 26 festivals escaped cholera with two exceptions, in one of which at Trivettore, in Chingleput district, there was cholera in the town a month before the festival began. In this state of matters 5,000 added people was not a favourable condition, and 15 of them died of cholera, but, as if to mark the danger of arriving at such a time, cholera ceased three days before the termination of the festival.

10. The other case was at the Kartigai festival, in South Arcot, where 25,000 people were assembled. In this instance, three deaths took place among incoming pilgrims, but the disease did not spread beyond these.

11. In three instances, where in all 67,000 pilgrims were assembled, cholera was in the vicinity of the places of pilgrimage, but no pilgrim suffered.

12. It thus appears that 24 festivals, attended by 488,000 pilgrims, escaped cholera altogether, and that the two attacked cases were accounted for by the circumstances at the time. In every case sanitary measures for protecting water, for cleansing, and providing latrines, appear to have been more or less successfully carried out, but as all such measures in the case of towns having local authorities should be in addition to the customary sanitary work, it would be very advisable that future reports should state more explicitly what were the sanitary precautions taken in each case.

2nd July 1883.



REPORT

ON

SANITARY MEASURES IN INDIA IN 1881-2.

TOGETHER WITH

MISCELLANEOUS INFORMATION UP TO JUNE 1883.

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1883.